

PACIFIC DISCOVERY

50 CENTS



The California Grizzly—State Animal

CALIFORNIA ACADEMY OF SCIENCES

July-August 1953

VOLUME VI • NUMBER 4

A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD



Miss Eastwood was guest of honor at ceremonies in celebration of the 100th Anniversary of the California Academy of Sciences. *Left to right, Christine and Madelon Morgan, Dr. Robert C. Miller, Miss Eastwood, and J. Ward Mailliard III.*

To Honor Alice Eastwood

Miss Alice Eastwood, distinguished Curator Emeritus of Botany and a truly remarkable woman of 94, has devoted her lifetime to making a knowledge of plants available to all of us. Here is a plan to make certain that her fruitful lifework will be made permanently available and increasingly valuable to future generations:

The California Academy of Sciences has authorized a public fund campaign to raise \$251,500 for the construction of an Alice Eastwood Hall of Botany at the Academy.

The new hall of plants and flowers will house the Eastwood Herbarium, a collection of 357,000 plant specimens that was built by Miss Eastwood herself. It will also provide space for a specialized botanical library and contain areas for popular exhibits of flowers, gardens, and landscaping.

The Alice Eastwood Hall of Botany will have significance to all those who treasure Nature's world of plants . . . a world of beauty that extends from tiny desert flowers that bloom briefly in the spring to stately

redwoods that silently watch generations come and go. By participating in this appeal we have the opportunity of bestowing a richly deserved honor on a great woman scientist. More than that, we will be giving tangible and permanent expression to our own appreciation of the never-ending wonders of Nature.

Feeling certain that you will wish to share as generously as you can in this significant undertaking, we urge you to mail your contribution to Mr. J. K. Moffitt, Treasurer, Alice Eastwood Hall of Botany, Room 819, 111 Sutter Street, San Francisco 4.

Your gift, deductible for income tax purposes, will be recorded and sincerely appreciated.

Campaign Executive Committee



When did you and your family last visit your

California Academy of Sciences

Did you know—



On April 4, 1953, the California Academy of Sciences, in Golden Gate Park, completed a century of service to California and the world of science.



Each week thousands of viewers see the pageantry and drama of the heavens unfold in Morrison Planetarium, which has been hailed as the world's best "theater of the stars."



There are 7,000 fish in Steinhart Aquarium. It's the second largest aquarium in the country.



The Academy's large staff is continuously engaged in research in the natural sciences. Its study collections of insects, fishes, birds, mammals, reptiles, amphibians, and plants make up a library of basic information that is drawn on by scientists throughout the world.



PACIFIC DISCOVERY, a bimonthly science magazine, is published by the Academy. Written by scientists, it is authoritative and as vitally interesting as nature itself. Beautifully illustrated.



The Academy offers inspiration, education, relaxation, and entertainment to all visitors, young and old.



Visit the Academy soon!

MORRISON PLANETARIUM • July & August: Performances daily (except Monday and Tuesday) at 2:15, 3:30, and 8:15 p.m. An extra show at 1:00 p.m. on Saturday and Sunday, and a special children's show at 11:00 a.m. Saturday.

HALL OF SCIENCES • AFRICAN HALL • NORTH AMERICAN HALL • STEINHART AQUARIUM

A JOURNAL OF NATURE AND MAN **PACIFIC DISCOVERY** IN THE PACIFIC WORLD

Editor and Art Director: DON GREAME KELLEY • Managing Editor: ROBERT C. MILLER
Associate Editors: A. STARKER LEOPOLD (University of California) • IRA L. WIGGINS (Stanford University)
BENJAMIN DRAPER, ROBERT T. ORR, EDWARD S. ROSS, VERONICA J. SEXTON (California Academy of Sciences)
Contributing Editor: RUTH E. HOPSON (Oregon) • Advertising and Circulation Manager: RUEL R. CROCKER, JR.

Vol. VI • No. 4
July-August
1953

HAS THE AGE OF DISCOVERY ENDED "because the North Pole and the South Pole have been attained and the general design of the mountains, deserts, and drainage systems of the earth has become known?" Isaiah Bowman asked 30 years ago. "Discovery can hardly be said to be ended," the great geographer went on, "until we have studied every people in the world in its peculiar physical setting, made nations known to one another, and perchance lessened our troubles by revealing us to ourselves" (*Desert Trails of Atacama*, American Geographical Society, New York, 1924, pp.1 f.). When the former president of the AGS and late president of The Johns Hopkins University said, in the same book (p. 1), "the map is still crowded with scientific mysteries though its great historic mysteries have been swept away," he illustrated the latter kind by "the Mountains of the Moon, the sources of the Nile and the Congo, the secrets of the inner Sahara, the heart of Tibet" — historic mysteries that explorers have "dispelled one by one."

One great historic mystery, albeit of a different kind, still challenges explorers. It is being attacked as part of the study "of every people in the world in its peculiar physical setting" — whence came the Polynesians? A year ago we discussed editorially some of the going theories on this one of mankind's most fascinating enigmas, and will do so again, after we have digested as well as we can a staggering new book that has just been served up for everyone who is at least a gourmet of Pacific history. Thor Heyerdahl has catered in reverse: *Kon-Tiki* was tangy dessert, *American Indians in the Pacific* is pièce de résistance. The tremendous new work has a cosmopolitan flavor — written by a Norwegian anthropologist, it was first published in English by George Allen & Unwin, Ltd., London, and the American edition was printed in Sweden for Rand McNally & Company, Chicago (912 pp., including 90 pp. of color, black and white photographs, \$15.00). The publication date is July 20, as we go to press. With an advance copy in hand, we can say this is one of the handsomest and most intriguing books we have seen in a long time. Whether or not one is swayed by or ultimately yields to the author's unorthodox view, the book holds the promise of an exciting reading adventure for us amateurs in the field, and is a serious anthropological work that every honest fellow-professional of the author's must take into account. Amateur or professional, read with an open mind!

Dr. Lloyd Glenn Ingles has returned to his professorship at Fresno State College after the year of leave which took him and his family to "Barro Colorado," other Central American points, and Mexico. . . . ¶ M. W. F. Tweedie, M.A., C.M.Z.S., director of the Raffles Museum and Library, Singapore, returns to PD with another brief account of interesting facts from the lives of Malayan butterflies. . . . ¶ Lawrence A. ("Larry") Williams, free-lance science and radio feature writer of Alameda, California, has written scripts for the Academy's TV program, "Science in Action," and for the University of California science radio program, "The University Explorer." . . . ¶ Dr. Loye Miller, emeritus professor of zoölogy in the University of California, has removed to Berkeley from the Los Angeles campus. All who enjoyed *Lifelong Boyhood* will be delighted to discover his essay on "California's First Fossil Bird." . . . ¶ Dr. Tracy I. Storer, head of the Division of Zoölogy on the Davis campus, and his associate Lloyd P. Tevis, Jr., have been working together for many months to gather all available information on "The California Grizzly." They would like to hear from anyone who has any relics, replicas, records, or reliable information pertaining to that undoubtedly extinct but no less official State Animal of California—they are writing a book about him. D.G.K.

COPYRIGHT 1953 BY CALIFORNIA ACADEMY OF SCIENCES

IN THIS ISSUE

<i>Barro Colorado—Tropical Island Laboratory</i>	
LLOYD GLENN INGLES	2
<i>Delias, Friend of the Trees</i>	
M. W. F. TWEEDIE	8
<i>Digging for History at Drakes Bay</i>	
LAWRENCE A. WILLIAMS	10
<i>California's First Fossil Bird</i>	
LOYE MILLER	18
<i>The California Grizzly—Emblem of the Golden State.</i> TRACY I. STORER & LLOYD P. TEVIS, JR.	22
ASTRONOMY: The Milky Way	28
REVIEWS	30



THE COVER COPY

THE CALIFORNIA GRIZZLY (*Ursus californicus*) was officially adopted in 1953 as California's State Animal. Our half-tone of Don Greame Kelley's color drawing is reproduced by kind permission of Mr. Fred W. Links, Assistant Director, California Department of Finance. The bear's "keeper" will be Dr. J. N. Bowman, State Department historian and archivist.

PACIFIC DISCOVERY is published bi-monthly at Gillick Press by the California Academy of Sciences. Publication office: 2057 Center Street, Berkeley 4. Editorial and Advertising offices: Golden Gate Park, San Francisco 18. Subscriptions: \$3 per year; single copies: 50c. Members of the Academy subscribe through their dues. Entered as second-class matter, February 17, 1948, at the Post Office, Berkeley 4, California, under the act of August 24, 1912.

NEAR THE FOREST-EDGE two rufous motmots, their voices an octave apart, greet the dawn with short bursts of hollow hoots. High overhead a pair of red-lored parrots squawk raucously, making a noise out of all proportion to their numbers, as they plunge swiftly down to become silent in the verdure of the forest. Then, far up the ridge from the giant branches of a towering Bombacopsis tree, comes the first deep-throated roar of a howling monkey and another sultry tropical February day begins. This day finds us on Barro Colorado Island in the middle of Gatun Lake beside the world's greatest highway, the Panama Canal. Many years ago, as the Chagres River was dammed to form the lake, six square miles of fine tropical forest on higher ground became Barro Colorado Island. How the persistent efforts of James Zetek, its local director, William Morton Wheeler, Thomas Barbour, Frank Chapman, and other fine scientists finally culminated in getting the island set aside under the auspices of the Smithsonian Institution as a tropical wildlife reserve, with a laboratory for many kinds of tropical research, is a story all its own. Here a scientist, or any person interested in nature, may come, live under comfortable conditions, walk over machete trails cut through the forest, and study anything he wishes. Nearly 700 publications based on research done on the island speak well for its importance as a scientific institution.

It was here my wife Elizabeth, our five-year-old son John, and I settled down for an entire winter after an arduous trip by car as far as Nicaragua over the Pan American Highway. Barro Colorado is not a jungle or a tropical rain forest in the technical sense because it does have a dry season during the winter months when only 10 to 15 inches of rain falls. The rest of the year, however, there are over 100 inches of rain, but the decrease during winter months gives this forest a different character from those tropical forests that experience no dry season, hence it has been classified as a Tropical Seasonal Evergreen Forest. In these beautiful primeval woods as many as 60 to 80 species of trees and shrubs may grow on an acre.

All of these forest elements are bound and laced together by hundreds of large woody lianas and

smaller herbaceous vines, making a canopy so tight that only scattered small spots of sunlight reach the ground at any one time. Under this protective canopy one may stand for several minutes after the start of a heavy shower before he feels a single drop that finally gets through the mass of leaves above him. In the deepest parts of these woods there is twilight at noonday and lightning bugs or fireflies may be seen emitting their tiny lights. Here a photoelectric light meter will measure less than 0.2 foot-candles at noon even on a cloudless day. It is a forest where the biologist sees organic pressures for survival at their highest. It is a forest where nearly every plant form, where nearly all animal behavior traits are used by some other species with its own special adaptations to attain its own survival. Thus the interrelationships and dependencies of this biotic community are infinitely more intricate and more complex than those of temperate regions. One has to walk only a few yards over any trail to see these interrelationships. Here, for example, is a strangler fig over 50 feet above the ground with its root system running down into the earth by going along and around the trunks of three other trees. One of these supporting trees is entirely gone, leaving a hollow tube formed by the anastomosing roots of the fig. Another of the fig's victims is dead and rotting away as it is held upright by the entwining roots of its murderer. The third tree is still living but is doomed to die by strangulation just like its neighbors. On the place once occupied by these three trees, one over three feet in diameter, there will eventually stand one giant fig tree on its three sets of strong tubes of roots which give the trunk of the fig a big advantage over other trees by holding it up 50 feet or more above the forest floor. From its elevated position it grows on up into the bright sunlight above the upper canopy of the woods. The strong fig will also be used by other lesser kinds of plants to get their food-making fronds and leaves into more and more sunlight. Already there are long lianas swinging down from its leafy crown and on its larger branches grow ferns, orchids and bromeliads. Some of these epiphytes have leafy cups that catch and hold rain water in which a peculiar fauna lives. Cer-

TROPICAL ISLAND LABORATORY

tain species of mosquitoes and amphibians, for example, live and reproduce only in these tree gardens high above the ground.

The fig itself started from a tiny seed that perhaps was left on a limb of one of these trees by a bird or a monkey many years ago. After germinating it grew as an epiphyte until its long roots followed down the three trunks to the ground. Once in the moist earth the tree grew rapidly and its entwining roots sent out many laterals to embrace its hosts and eventually to choke them to death.

Only a few feet from the strangler fig stands a stilt palm. This remarkable tree may be less than six inches in diameter and yet it extends its leafy crown 60 to 70 feet out into the upper canopy. But what enables a stilt palm to stand up? From the lower part of its slender trunk many bracing roots grow out several feet above the ground. Thus the strangler fig and the stilt palm solve in different ways their problems of getting up into the light.

Under the stilt palm across the dark forest floor a column of army ants moves along swiftly.



Few birds of the tropical forest show more color than the black-throated trogon (*Trogon rufus*). The iridescent blue-green head and bright yellow belly are bright flashes even in the deep shade of the forest.

These ants represent one of over a dozen species found on the island and have been studied for many years by Dr. T. C. Schneirla of the American Museum of Natural History. The raiding columns of these ants catch, kill, and carry back to their bivouac all kinds of arthropod animals, especially their larvae and pupae, to feed the busy colony. Accompanying each army ant raid are five or six species of ant birds which do not eat the ants but catch the insects that are flushed by their advancing columns. Dr. Alexander Wetmore, noted ornithologist and chairman of the Smithsonian Institution, told me that when he wanted to find certain species of birds he simply followed a column of army ants to its advancing front and almost certainly the birds would be there.

In the forest practically all of the mammals are adapted by structure and behavior to living in the trees or on the ground, with a number that spend considerable time in both. Of the tree-dwelling mammals certainly none is more spectacular than the Capuchin monkey which is found all over the island in troops of 15 to 25 individuals.



This Capuchin monkey (*Cebus capuchin*) was tempted to come down to the forest floor with star apple bait.

These troops may be strung out a hundred yards or more through the tree tops. It is not unusual to see one of these active little monkeys jump and fall 20 to 40 feet into a lower tree. Never did we see one miss its landing. One evening we watched at close range a troop advancing along the margin of the lake. One old male interested himself in making the large iguanas that rest on branches over the water jump down into the lake. This monkey broke off every dead branch that it could find and threw it into the water. Whether the Capuchin was clearing a new monkey trail of reptiles and dangerous limbs or whether it just liked to see and hear things splash in the water is hard to say, but I am inclined to believe the latter.

Another curious creature that is almost entirely arboreal is the three-toed sloth. This sloth appears to eat only the leaves of the Cecropia tree and is therefore practically never seen in temperate zone zoos. One day in the deepest forest I heard a loud squealing and growling in the canopy almost overhead. While I was trying to locate the cause of the disturbance two male sloths came tumbling out of a palm tree fully 30 feet above the ground. Each sloth had a firm grip on the other with its hind feet and it was quite apparent they had been fighting and had become so occupied that they had forgotten gravity was still an active factor of their environment. A few seconds later they began to recover from their fall. They let go their holds and wobbled and rolled awkwardly over the ground to the nearest lianas which they slowly began to climb. We needed pictures of a sloth so one was captured with a loop on a pole and was carried out to a clearing a half mile away where there was sufficient light for photography. The grayish green of their coarse hair and their slow method of locomotion on the under side of limbs make them difficult to find even where they are plentiful. The greenish color is the result of an alga growing on the hairs. There are also three species of moths and one beetle that are almost always found darting in and out of the coarse pelage. Whether the larvae of these insects eat the alga, the hairs, or the tiny sloughed-off bits of epidermis appears to be another problem of interrelationships in the intricate web of this tropical forest community that needs to be investigated much more thoroughly.

A mammal that seems to be equally at home in either arboreal or terrestrial environments is the three-toed anteater or *Tamandua*. Its long prehen-



The three-toed anteater (*Tamandua tetradactyla*) is both terrestrial and arboreal. It eats ants and termites which it extracts from deep burrows with its very long round tongue.

sile tail enables it to use tree routes of travel and to work on insect nests far above the ground. With the powerful claws on its front feet it can open the hard, tough ant and termite nests without difficulty. Its most striking adaptation, however, is its long worm-like tongue that can be extended from the mouth five inches or more to extract insects out of the intricate and interlacing system of tubes found in termite and ant nests. While raiding a nest of termites or ants a tamandua would soon become covered with biting or stinging insects were it not for the way it uses the claws on its hind feet. These claws are arranged along the foot in the form of a comb with which the anteater keeps its pelage relatively free of insects by combing almost constantly with its hind feet as it continues to feed.

There are many strictly terrestrial mammals but none is more frequently seen in the forest than the agouti or *neque* as it is called by the Panamanians who prize its flesh as a table delicacy. The agouti belongs to a group of South American-type rodents that have moved up through Central America since the Ice Age. It is commonly seen in daytime eating the fallen fruits of various forest trees and when surprised squeals loudly and dashes off to its burrow. No doubt the agouti provides much food for jaguars, pumas, and ocelots.

Near the laboratory at the edge of the forest is a bread-fruit tree which was introduced long ago. One evening we watched a pack of coatis climb the tree to search for ripe fruit. Although a carni-



Three-toed sloths (*Bradypus griseus*) are almost entirely arboreal.

vore, the coati, which is related to the raccoon, has similar omnivorous habits. It includes considerable fruit in its diet. When one of the coatis found a ripe breadfruit it was dropped to the ground with a loud *plop*. At that instant all of the other coatis immediately began descending the tree to partake of the meal, and to our surprise, three agoutis came out of the burrows and sat within three or four feet of the feasting coatis waiting to clean up any leavings. Thereafter we noticed that the agoutis nearly always appeared when one of the three-pound breadfruits fell.

The largest mammal on the island is Baird's tapir which lives in the deep forest and is seldom seen. Three years ago two young tapirs still wearing their longitudinal stripes were brought in to the laboratory from the mainland. They were fed and cared for until they were old enough to take care of themselves in their native habitat to which they gradually returned. Occasionally even now one or both of these tapirs will wander out of the woods into the laboratory clearing where they still look for "hand outs" of potatoes and bananas. I shall never forget the beautiful sight they pre-



The little two-toed anteater (*Cyclopes didactylus*) is nocturnal and so is rarely seen.

sented one morning as they walked slowly out of the forest into full sunlight not 25 feet away from the bird blind where I had my camera all set for a chestnut-mandibled toucan. It was a rare opportunity to photograph, in its native habitat, this large mammal which belongs to the same zoological order as the horse and the rhinoceros. An entomologist once came to visit the island and no one told him about the young tapirs. One day while he was busily collecting insects in a dark ravine he heard a high pitched whistle and looked up to see two large mammals slowly approaching only a few feet away with their long snouts extended toward him. He quickly abandoned his work and climbed a small tree. The tapirs walked



◀ The largest mammal on the island is Baird's tapir (*Tapirella bairdi*). These two were photoflash early one evening on a forest trail near the laboratory clearing.



ψ The agouti or ñeque (*Agouti dasyprocta*) is frequently seen even in daytime in the deep forest. These South American-type rodents are very shy and can run rapidly.

around the tree still whistling and finally one of them lay down at its base! He hardly expected anyone of us to believe his story when he returned to the laboratory that afternoon. He never told us how long long he remained up the tree to avoid the big animals that only wanted him to give them a banana or a potato!

There are at least 15 species of bats known to occur on Barro Colorado and on the nearby mainland. So far as known each species is adapted to roosting and feeding in its own particular way. For example the Watson's bat makes its own roost-



← The coati (*Nasu* sp.), like its relative the raccoon, is an omnivorous feeder and frequents the forests in small bands.

➤ Iguanas (*Iguana* sp.) are often seen climbing in the highest trees around the shore.

Photographs by the Author



ing place by cutting the veins in the leaves of two species of small palms in such a way as to cause the leaf to droop, forming a "tent." The bats hang head down inside this little green tent and no doubt are somewhat protected from the bat falcon and other predators as well as from heavy rains in the wet season. The tent also serves to darken still more their roost in the deep woods where the palms grow.

Only a few examples of the interesting adaptation found in this tropical forest can be given here. Barro Colorado is a place that must be experienced to be fully appreciated. Pictures even in natural color can only give a poor notion of the curiously adapted forms that live in a tropical forest. They are but poor sketches and representations of the great number of interdependencies that make up biotic communities.

▲ The Central American armadillo (*Cabassos centralis*) is rare in Middle America. This one, discovered by the author's wife, was the first ever seen on Barro Colorado.

➤ The nine-banded armadillo (*Dasybus novemcinctus*) ranges all the way from South America into Texas. It is very common on the island.

JULY-AUGUST 1953

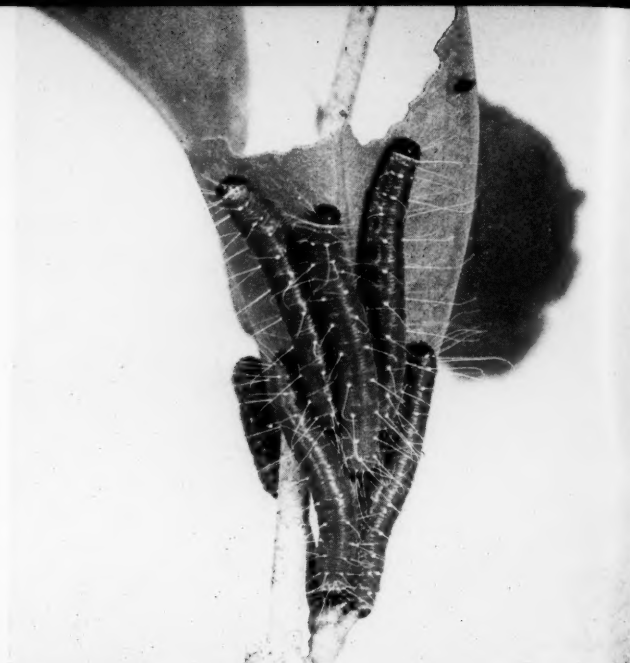


There are, of course, some annoyances and real dangers as one walks over the trails. Personally, I regard the constantly high humidity as the greatest annoyance. After only moderate exercise one becomes entirely wet with perspiration even in the dry season. It causes one's glasses to fog over at the most inopportune moments. It causes fungus to grow on clothes, shoes, camera cases, and in camera lenses. It causes films to stick in even the best cameras. Some people, until they learn to deal with them, find the great number of chiggers and ticks a never ending source of trouble. Proper dress for the trails and proper bathing can, however, usually reduce these to an insignificant minimum. The dangerous bushmaster has never been seen on the island, although it is occasionally found on the mainland. The poisonous reptiles which may be seen along the trails are very few although I photographed a fer-de-lance and a coral snake on a trail on the same day. A bite from either would be grave disaster indeed. There are very few mosquitoes, no malaria, no houseflies.

The forest closes in on both sides and behind the laboratory. One does not see far into or through these woods; they are too dense. Only in front can a person look away across Gatun Lake, and there within a mile of the laboratory see the great ships of the world move silently along the Panama Canal. They are the only reminders of an outside civilization for on the island there are no television sets, no radios, no telephones, no cars, no newspapers, no dogs to bark, no cats to meow. There are only the native wild sounds of the forest, which taken alone may seem loud and raucous but, which somehow blend with the whole to make something pleasing and soothing to the nervous system of civilized man.

Each evening about sundown the big chestnut-mandibled toucans mount the top branches of the tallest trees and with much bowing and waving of their enormous beaks break the solitude with their loud squawks and yippings. One does not mind this, however, because he has learned that the next number on the program will be the long wailing flute-like notes of the great tinamou which serve as vespers every evening on Barro Colorado. When the tinamou has sung his song the nocturnal chorus of the insects and amphibians has already begun. Many bats are darting about and then, the mellow hoots of a spectacled owl greet the night from the dark forest. There should be more Barro Colorados.

END

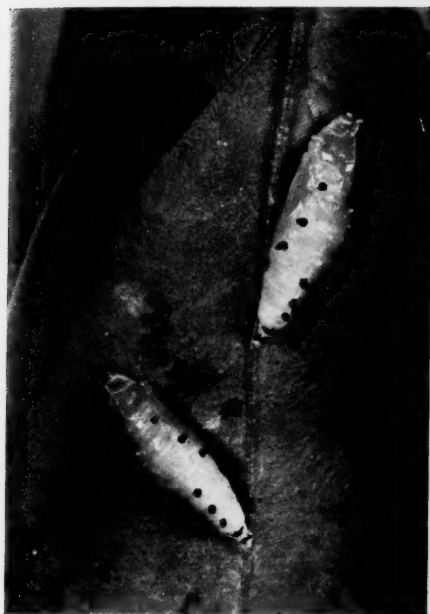


Delias, Friend of the Trees

M. W. F. TWEEDIE

IT IS SAID to be almost impossible to frame a biological law that shall be of universal application. Even the apparently self-evident one, that phytophagous insects are enemies of vegetation, has its exceptions, for plants have foes in their own ranks, leech-like parasites that grow on them and suck their living sap, and these, like practically all plants, are food for certain insects.

The life histories of only a few species of *Delias* have been recorded, but from what we do know of them it seems likely that the larvae of all these gaudy tropical butterflies feed on the Lorantheae, the mistletoes, parasites of trees. One species, *Delias hyparete*, is a common butterfly of the Malayan lowlands, and I found a number of young larvae on a small *Loranthus* growing on a *Gardenia* bush in my Singapore garden. Some of these I took and bred to furnish the photographs reproduced here. As my captive larvae neared maturity I found that their appetites and those of the ones left on the bush were reducing the stock of *Loranthus* to a dangerously low level. I had no other plant available, so I took the rather drastic precaution of removing all the wild larvae; even so the supply only just provided for my captives. If the brood had been left to itself it would surely have defoliated the *Loranthus* entirely and probably perished



↑ *Delias hyparete*, the pupal stage, and
→ the imago. (Photos by the author)



thereafter from starvation. The plant would not be killed, for these parasitic plants obviously do not depend wholly or even mainly on their leaves for their subsistence, but I have no doubt that its growth would be inhibited and the Gardenia bush have cause to be thankful to *Delias*.

I have mentioned that these butterflies are gaudy; nearly all have the under side of the hind wing boldly patterned with red, yellow and black. Now it is a very general rule that in gaily colored butterflies the brilliant pattern is on the upper surface of the wings so that it is visible in flight or when the wings are extended, but concealed in the normal resting position. Often, as in the leaf butterflies (*Kallima*) and many amathusiids, which have the wings brilliant on the upper surface, the under side is leaf-like and cryptic. But *Delias*, like others of the pierid family (cabbage butterflies) to which they belong, sit with their wings dorsally erect, their upper surfaces apposed and the greater part of the fore wings concealed between the hind ones. Here the area of wing which is exposed when the insect is at rest, so far from being dull or cryptically colored, is just that part which is most conspicuous.

Now *Delias* are well known to be distasteful to insectivorous animals, and they serve as models for

a number of butterflies belonging to distinct genera, which exhibit the phenomenon of mimicry. Clearly this deliberate flaunting of their bright colors is aposematic, a warning to predators: "leave me alone; if you try to make a meal of me you may maim or kill me, but it will be the worse for you." Probably these butterflies derive their distasteful or unwholesome character from the poisonous *Loranthus* which the larvae eat, just as do the *Aristolochia*-feeding caterpillars of the magnificent *Troides* swallow-tails. *Delias hyparete*, at least, seems to resort to this deliberate conspicuousness throughout its life history. The larvae are yellow with long white hairs and black heads, and gregarious, and the pupae pure white with sharply defined black points.

Although *D. hyparete* is common in the lowlands, most of the species of *Delias* are mountain butterflies, many of them found only on high peaks. In such isolated habitats, and also on the islands of the tropical Indo-Pacific, distinct species and subspecies are evolved. This fact, together with their brilliant coloration, has resulted in *Delias* being specially sought after by collectors. Aposematic coloration gives no protection against those predators whose appetite is aesthetic or scientific curiosity, and whose weapons are nets and cyanide bottles.

END

When the explorer Chamisso visited the San Francisco Bay area in 1822, he sketched these Indians that may have been descendants of the natives who greeted and crowned Francis Drake in 1579 — the crown was a feather headdress.



Illustrations courtesy the University of California

DIGGING FOR HISTORY AT

Drakes Bay

LAWRENCE A. WILLIAMS

AT A TIME when Chinese porcelain was worth its weight in gold and considered a fitting gift to Elizabeth I of England or Philip II of Spain, naked California Indians were dining from plates and bowls of the Wan Li period of the Ming dynasty.

Two centuries before white men established the first settlements on the Pacific coasts of our country, these same Indians gazed "as men rauhished in their mindes" at a party of Englishmen led by Francis Drake.

After giving Drake a welcome unique in history, after a five-week visit during which they watched the English sailors careen the *Golden Hind* and repair her on their beach, "... they tooke a sorrowfull farewell of vs, but being loath to leaue vs, they presently ranne to the tops of the hills to keepe vs in their sight as long as they could. . ."

Twenty-five years before the Pilgrims landed on Plymouth Rock, the small tribe of Indians in California welcomed a second group of visitors: Spaniards led by the Portuguese pilot, Sebastián Rodríguez Cermeño, whose ship, the *San Agustín*, was wrecked on their shore.

The story of the local tribe occupying a small point of land in the vast wilderness of the Pacific coast, roused from the ancestral life pattern of thousands of years by the visits, within a generation, of two great ships with crews of pale, armed men, and then returning to the uneventful

stone-age life for another two hundred years — this story is being unraveled by archeologists of the University of California, aided by historians, ethnologists, and specialists in many other fields.

Drake's men were certain these Indians had never seen white men before. Cortés had conquered Mexico City in 1521; Coronado had searched for the cities of Cibola in 1540. Farther south, in what is now San Diego and Santa Barbara, the Indians saw Cabrillo's crews and told about bearded men far inland who rode horses and killed natives.

But had the Coast Miwok Indians heard tales of the conquistadores, they would not have acted as they did. Francis Fletcher, the preacher who accompanied Drake, described the scene. Drake had sailed for the South Seas in five small ships and with 166 men, December 13, 1577. When he finally made it through the Straits of Magellan, two vessels had been set adrift and two had turned back to England. As the first Englishmen in the Pacific the crew of the *Golden Hind* took the Spanish by surprise. They pillaged and plundered ships and ports, and heavy with booty, they sailed north to escape the aroused Spaniards. It was June 17, 1579, that they found a "conuenient and fit harborough" in what they recorded as 38 degrees 30 minutes latitude.

Drake prepared for any native trickery or hostility, but he and his men were astonished and dis-



tressed at the reaction of the Indians. They were awestruck. They lacerated themselves, cast themselves down on rocks and thorns. They presented the English with baskets decorated with feathers and pearl-shell beads, and they burned baskets and strings of beads.

Fletcher thought the natives were doing this as sacrifice to the gods — the English being regarded as gods come to earth. We now know that these are ceremonial observances by which the Coast Miwok Indians honored the dead. To them, Drake and his men were the returned dead. This explains the "most lamentable weeping & crying out . . . and most doleful manner of shrieking" which followed the first contact of Indians and Europeans in this remote place.

The journals of Fletcher and of other men who shipped with Drake contain accounts of the dress of the natives: the men naked, the women with bulrushes "which being knitte about their middles, hanges downe about their hippes, and so affords

to them a couering of that, which nature teaches should be hidden: about their shoulders, they weare also the skin of a deere. . . ."

The descriptions include housing, weapons, landmarks, animals, food supply. The houses of the Indians were dug into the earth and roofed with a teepee of timbers covered with earth. The English, used to their famous longbow, were contemptuous of the weak bows of the Indians—more fit for children than for men. The skill and strength of the natives, however, the Englishmen admired. From the white cliffs which faced the sea, reminding Drake of Dover, the captain named the land "New Albion."

The food of the Indians, the accounts say, included acorns, acorn bread, fish, sea lions, large and fat "Deere" (Roosevelt elk), and seeds. From this and from a small vocabulary of Coast Miwok words and phrases Drake's sailors remembered for some years after the California adventure, it is generally accepted as fact that the English

▲ One of several drawings of the crowning of Francis Drake by the California Indians (Gottfried, 1655). Two other 17th century versions of the event are reproduced in Robert Heizer's *Francis Drake and the California Indians, 1579*. Note the "plate of brasse" being raised — and the palm trees! Such illustrations of the voyages were commonly made by artists back home with the help of hearsay and imagination.

landed in what is now Marin County, California, a rugged, but beautiful country just north of the Golden Gate and lying between San Francisco Bay and the broad Pacific.

Most of the experts agree that Drake careened the *Golden Hind* just inside the crooked finger of land, Point Reyes, in what has been known since Spanish days as Drakes Bay. We know for certain that it was in this bay that Cermeño's *San Agustin* was wrecked, but for the past hundred years experts have suggested at least half a dozen other bays where Drake might have landed.

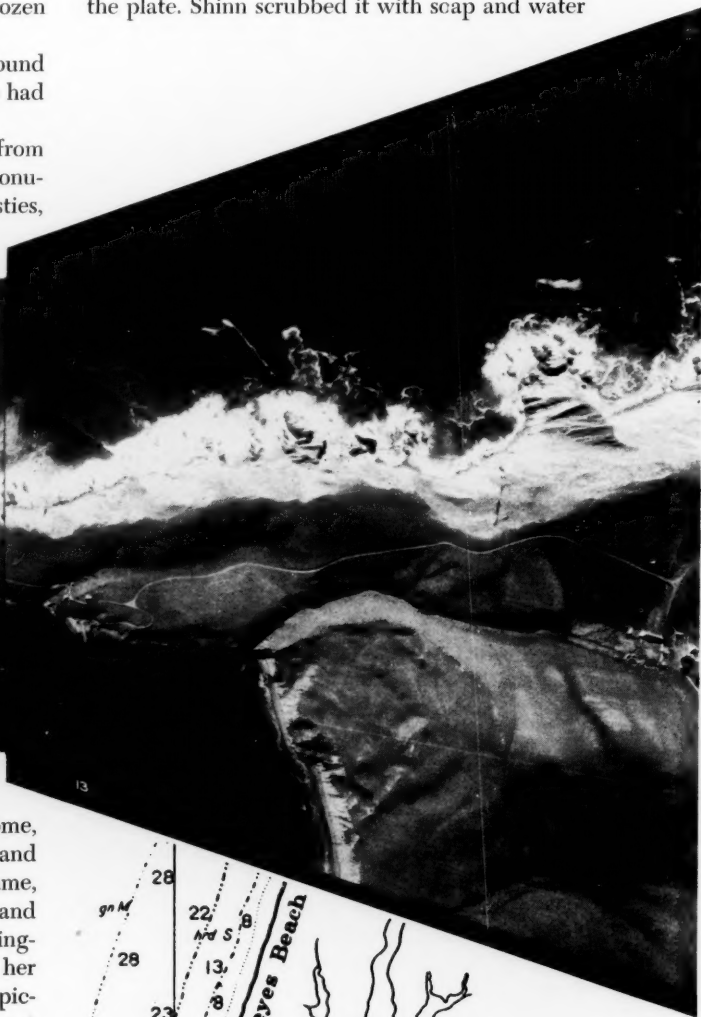
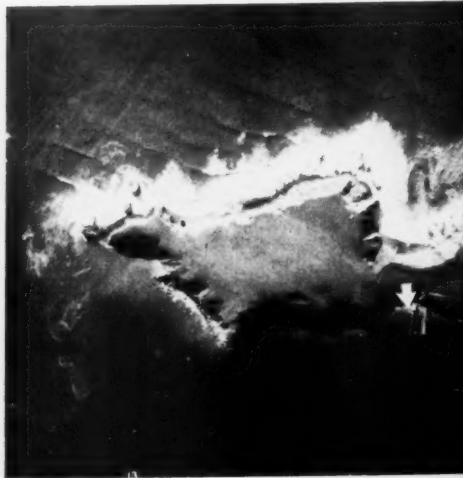
It wasn't until Drake's plate of brass was found in 1936 that we had tangible evidence Drake had actually been in central California.

Fletcher had written: "Before we went from thence, our generall caused to be set vp, a monument of our being there; as also of her maiesties,

San Quentin Bay, opening from San Francisco Bay into Marin County. Before changing the tire, he climbed the ridge, and on his return, saw a piece of metal only partly covered by a rock. It was five inches wide by eight inches long and an eighth of an inch thick. Shinn picked it up to cover a hole inside his car, and it lay on the floor of his car for over a month.

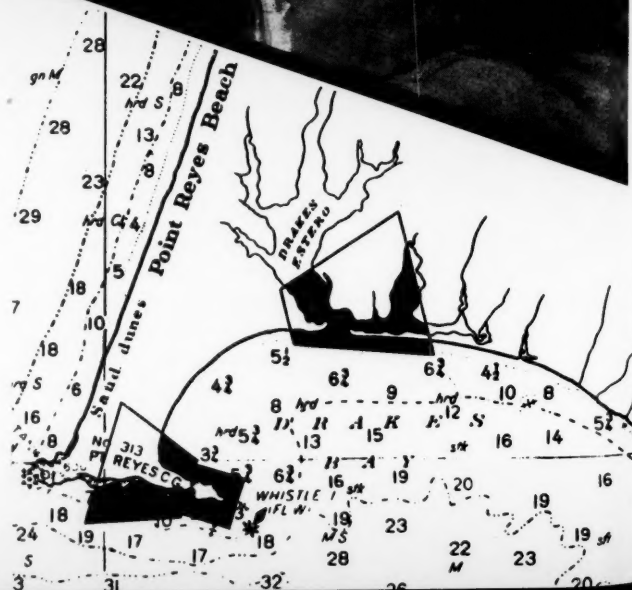
When he got around to the needed repair work, he noticed there was some form of inscription on the plate. Shinn scrubbed it with soap and water

Drakes Head, the east cape of Point Reyes. The arrow shows where Drake is believed to have careened the *Golden Hind*. Note the still water inside the point. Piers are those of the U. S. Coast Guard Station. North is down.



and successors right and title to that kingdom, namely, a plate of brass, fast nailed to a great and firme post; whereon is engrauen her graces name, and the day and yeare of our arriual there, and of the free giuing vp, of the prouince and kingdom. both by the king and people, into her maiesties hands: together with her highnesse picture, and armes in a piece of sixpence currant English monie, showing it selfe by a hole made of purpose through the plate: vnderneath was likewise engrauen the name of our generall &c."

In the early summer of 1936, Berle W. Shinn had a flat tire when near a ridge at the head of



12

Part of U. S. C. & G. S. Chart No. 5502 showing approximate plots of air views above and on the next page. North up.

and was able to recognize a few words. A friend, one who had studied California history under the late Professor Herbert E. Bolton at the University of California, made out the name, Drake, and suggested that Shinn notify the historian.

With further cleaning, Dr. Bolton uncovered:

BEE IT KNOWNE VNTO ALL MEN BY THESE PRESENTS.

IVNE. 17. 1579.

BY THE GRACE OF GOD AND IN THE NAME OF HERR MAIESTY QVEEN ELIZABETH OF ENGLAND AND HERR SVCCESSORS FOREVER. I TAKE POSSESSION OF THIS KINGDOME WHOSE KING AND PEOPLE FREELY RESIGNE THEIR RIGHT AND TITLE IN THE WHOLE LAND VNTO HERR MAIESTIES KEEPING. NOW NAMED BY ME AND TO BEE KNOWNE VNTO ALL MEN AS NOVA ALBION.

FRANCIS DRAKE.

To the right of Drake's name was a jagged hole into which an Elizabethan sixpence just fit, though the original was missing.

The University acquired the relic from Shinn and subjected it to many tests to verify the age of the brass and the genuineness of the patina. The investigators concluded that this was the same plate of brass Drake had nailed to the "great and firme post."

The plate bears dents that might have been made by Indian war clubs. Had it been carried here near San Francisco Bay from Drakes Bay? Had it always been here?

Partly to answer this question Dr. Robert Heizer, then a graduate student in anthropology at the University, led a party of student volunteers to Drakes Bay to do some digging. This was in 1940. The theory was that articles the Indians had obtained from the Drake party, or more probably, from the wreck of the *San Agustin*, would have found their way into the shell mounds — the refuse middens left by the Indians.

Setting up camp on Point Reyes, the archeologists began digging in two mounds on a bluff not far from the tip of the Point. Finding no historical material, they shifted operations around the bay to the shores of the two largest *esteros*, tidal estuaries opening onto the bay.

The weather was just as Fletcher had described it: "... notwithstanding it was in the height of Summer, and so neere the Sunne; yet were wee continually visited with like nipping colds, as we had felt before; insomuch that if violent exercise of our bodies, and busie imployment about our necessarie labours, had not compeld vs to the contrary, we could very well haue beene contented to haue kept our beds. . . ."

Entrance to Drakes Estero. The shovel marks the site where the first porcelain sherds were found; the anchor is about where the *San Agustin* foundered.

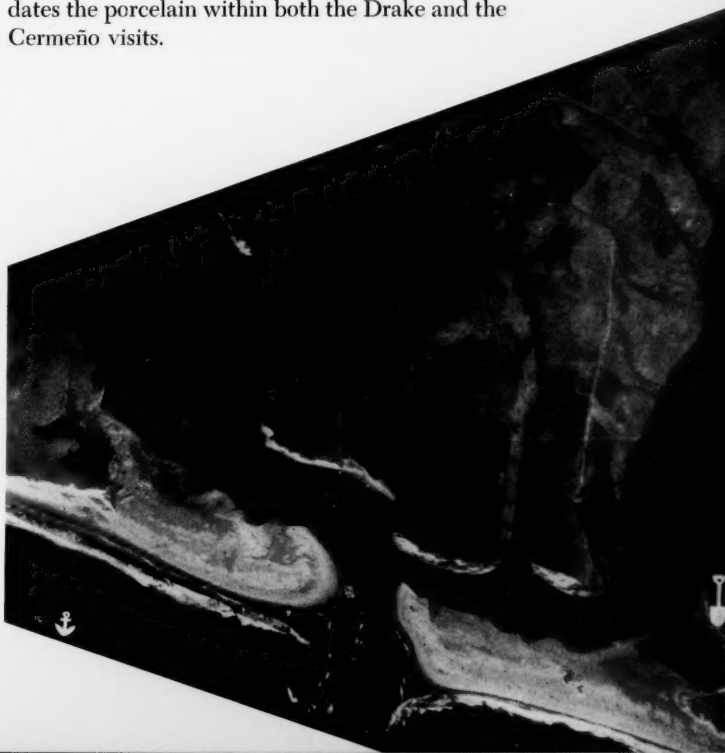
Now they were digging in middens of villages Heizer felt certain were ones described by Cermeño. Soon Alfred Métraux, Frenchman and non-student member of the party, called attention to a fragment of white china with a blue pattern glaze. "Is this anything we should save?" he asked.

"It might be important," Heizer said. It might only be something from Spanish mission days, but his thought leaped to the possibility that it might be from the *San Agustin*. That ship was known to be carrying a large cargo, and while porcelain was not specifically mentioned, it was logical to assume it would have been included.

"Oh, I'm sorry," Métraux said contritely, "I've been throwing some of those away." The digging and sifting of Indian and historical articles proceeded with added care and enthusiasm. Broken porcelain and large, rusted iron spikes were found in the upper layers of the mound. Then other mounds nearby were found to yield the porcelain sherds and rusted iron spikes.

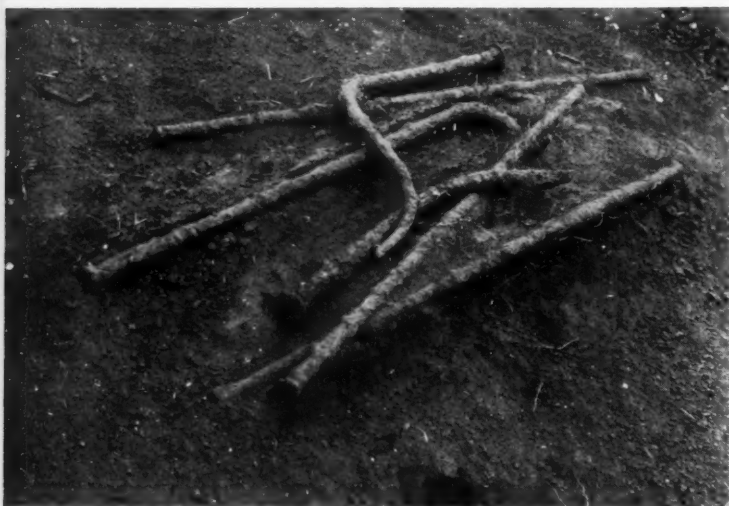
University expeditions in 1941, 1949, and 1950 uncovered more porcelain and iron mingled with shells and bones and arrowheads and charmstones. In all, 112 porcelain fragments from at least 38 vessels have been found in seven shellmounds. These include 16 plates of two different shapes, 10 bowls of three different shapes, and two fluted vessels.

Theodore Hobby, of the department of Far Eastern Art of the Metropolitan Museum of Art in New York, has identified the pieces as of late Ming dynasty manufacture. Most of the porcelain is from the Wan Li period (1573-1619). This dates the porcelain within both the Drake and the Cermeño visits.





Student volunteers excavate shellmounds at Drakes Bay.



The rusted iron rods, 1 inch by 4 feet, once joined keel timbers of the *San Agustin*. They were dug out of a Drakes Bay shellmound. (Clement W. Meighan, California Archeological Survey)

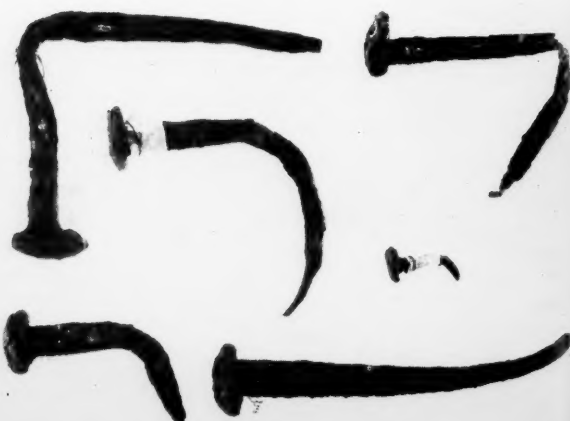


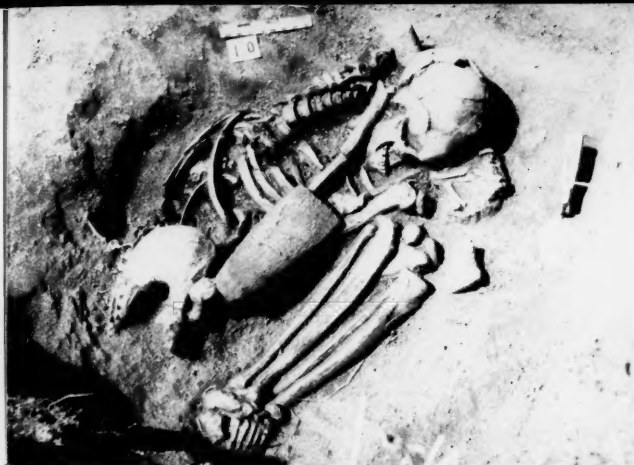
Alfred Métraux, French anthropologist, threw some precious porcelain sherds away before he realized their importance.

A partial list of sources

- BOLTON, HERBERT E., "Francis Drake's Plate of Brass," *Drake's Plate of Brass*, California Historical Society, Special Publication No. 13 (San Francisco, 1937).
- FINK, COLIN G., and E. P. POLUSHKIN, *Drake's Plate of Brass Authenticated . . .* California Historical Society, Special Publication No. 14 (San Francisco, 1938).
- HEIZER, ROBERT F., *Francis Drake and the California Indians, 1579*, Univ. Calif. Pub. in Amer. Archeology and Ethnology, Vol. 42, No. 3, University of California Press, Berkeley and Los Angeles, 1947. Pp. 251-302, plates 18-21, 1 fig. in text, 2 illus. Paper, \$1.25; cloth, \$2.00. This is the principal source, fully annotated and documented. Elucidates the methods of the archeologist and historian. Contains extract from *The World Encompassed by Sir Francis Drake* (London, 1628).
- HEIZER, ROBERT F., "Archaeological Evidence of Sebastián Rodríguez Cermeño's California Visit in 1595," *California Historical Society Quarterly*, Vol. XX, No. 4 (San Francisco, 1941).
- HEIZER, ROBERT F., and WILLIAM W. ELMENDORF, "Francis Drake's California Anchorage in the Light of the Indian Language Spoken There," *Pacific Historical Review*, Vol. XI, No. 2 (Glendale, 1942).
- Publications of the Historical Society of Southern California, Vol. II, Part I. Spanish documents 1584-1774 from the Sutro Collection, translated, annotated, and edited by Geo. Buttler Griffin.
- WAGNER, HENRY R., *Spanish Voyages to the Northwest Coast of America*, California Historical Society, Special Publication No. 4 (San Francisco, 1929).

Analysis shows these hand-forged soft iron spikes to be very old — evidence of European landings in Drakes Bay.





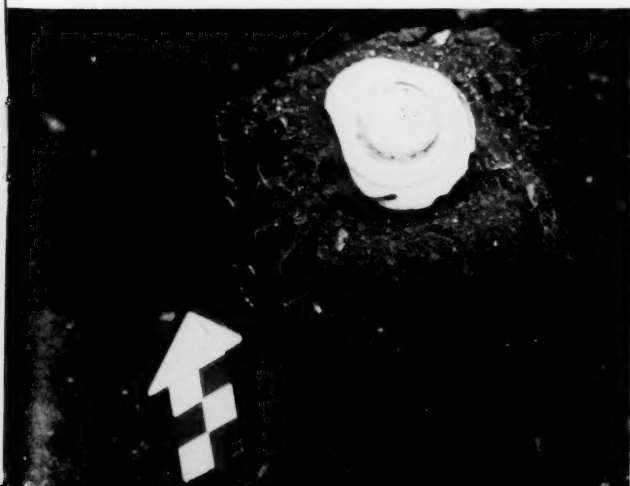
This Indian may have seen Drake and Cermeño — he lay in a shellmound along with fragments of Chinese porcelain.

The 65 iron spikes include several rods four feet long and one inch in diameter such as have long been used in wooden ships to hold the keel timbers together. Drs. Colin G. Fink and Eugene P. Polushkin, of the department of Chemical Engineering, Columbia University, who also had examined the Drake plate of brass, declared the iron to be of ancient origin.

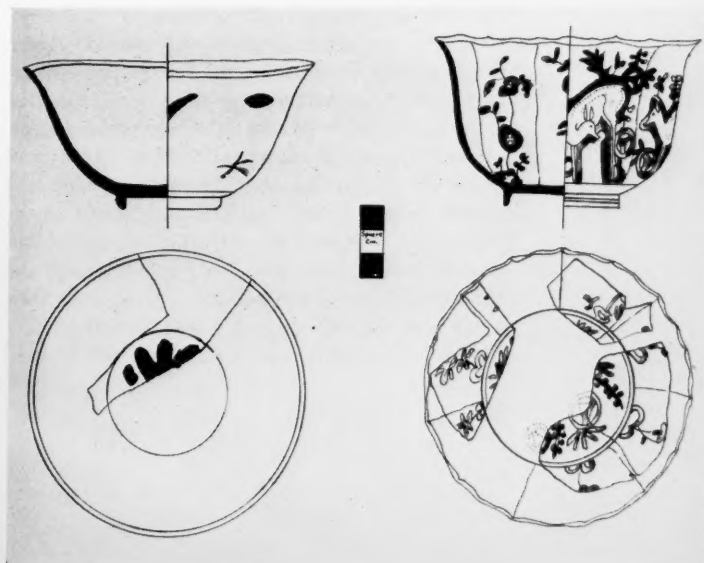
Drake's booty included Chinese porcelain he had liberated from Spanish ships, but it was of such value, he would not have given it to the Indians. And we have Fletcher's word that "Our Generall hauing bestowed vpon them diuers things, at their departure they restored them all againe; none carrying with him any thing of what-soeur hee had receiued. . . ."

Spanish records reveal that Cermeño's ship was carrying a large cargo when it was wrecked, and further, that the survivors had none of the cargo with them when they arrived in Mexico. It must have been from the *San Agustin* wreck that the Indians obtained their Chinese plates and bowls. It must have been from this poor ship that they took the planks to roof their circular, subterranean

One of the largest pieces of Chinese porcelain found at Drakes Bay. (Meighan, California Archeological Survey)



▲ Ming china fragments are evidence that the California Coast Miwok Indians got plates and bowls from the wreck of Cermeño's ship, the *San Agustin*, in 1595. ♣ Drawings show the reconstruction method by which archeologists found that 112 fragments from seven shellmounds belonged to at least 38 different vessels. (Clement W. Meighan, California Archeological Survey)



houses. And when the planks burned or rotted, the iron spikes found their way to the refuse heap.

Historians are delighted with the finds because they are among the earliest evidences of the meeting of Europeans with Indians on the Pacific Coast of the United States. The only earlier evidences are Drake's plate, and some beads of 16th century European manufacture found with Indian artifacts in the Santa Barbara region. It is possible the beads might have been left by Cab-rillo in 1542.

Archeologists likewise are delighted because they now have what one of them calls "a known time datum for the Indian culture in this part of California which is almost 400 years old." By the association of the Cermeño relics with Indian artifacts, we know what the daily life of these natives was like in 1595. From this we can evaluate the changes which have taken place in similar Indian cultures both before and after this time.

The porcelain and rusty iron dug from shell mounds on a cold and lonely point on the California coast are reminders of adventurous days. Cermeño was commissioned by Luis de Velasco, viceroy of New Spain, to explore the northern coasts of New Spain to locate a port where ships could stop for water and repairs, and to rest the crews, on the return from the Philippines. The Portuguese pilot was allowed to carry a certain number of tons of merchandise which was to compensate him for making the trip.

He sailed from Mexico, March 21, 1594, on the *San Pedro*. In the Philippines he transferred to the *San Agustin*, and on July 5, 1595, sailed from Cavite with 130 tons of cargo and over 70 men. They sighted the California coast well north of Cape Mendocino, entered Trinidad Bay, but did not land there because of the rocks.

Heavy wind and high seas endangered the ship, and the master, pilot, and boatswain presented Cermeño, captain and chief pilot, with a written demand that he sail directly for Acapulco. Cermeño, however, followed his orders, exploring the shoreline as he coasted south.

On November 6, he rounded Point Reves and anchored in Drakes Bay, which he called the *puerto de San Francisco*. Indians appeared on the shore, and as in the visit of Drake, a single Indian approached in a raft-like canoe and talked to the visitors. He was given gifts of cloth, as were four Indians who paddled out the next morning.

Cermeño went ashore with a party of 22 men

including 17 harquebusiers. He took formal possession of the land in the name of the King of Spain (not the first nor the last time the Queen of England and the King of Spain claimed the same territory).

Fifty adult natives in the village about a harquebus - shot from the beach were peaceful and showed great fright. Inland, a band of Indians

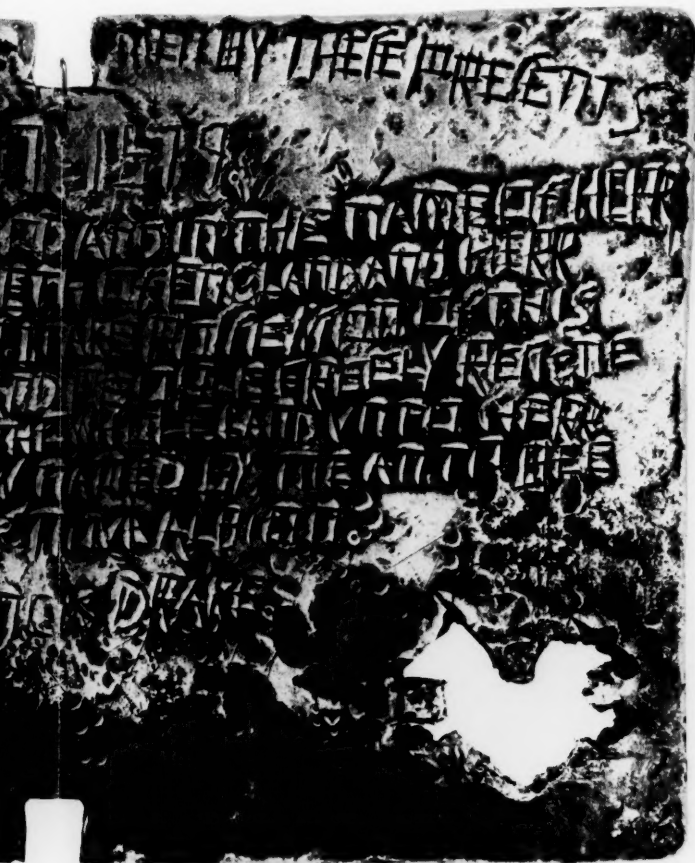


Photograph of Drake's plate of brass (approximately actual size) courtesy

skirmished in a circle around the Spaniards, uttering loud howls. One with a tall banner of black feathers approached to look them over. When two friendly Indians talked with the warlike ones, the attitude changed. As if terrorized, they approached in a humble manner and yielded their arms. The one with the banner presented it to the captain.

Here we have reenacted the same fright and ravishment with which these Coast Miwok In-

dians greeted Drake. The ceremonial black feather banner had also been given Drake by an Indian chief, or *Hioh*. Later the Indians visited the Spanish encampment and the chief and others talked a long time, duplicating the oratory with which Drake had been greeted. The houses, the food, the ceremonies, the large deer received similar descriptions.



ual size) courtesy of the Bancroft Library, University of California, Berkeley.

On the shores of Drake's Bay, Cermeño's men assembled the first pre-fabricated boat to be built in America. As it would be dangerous for a heavily laden ship to explore bays and rivers and points on the shoreline, a launch had been built in the Philippines and transported in pieces on the deck of the *San Agustin*. It was made of a large dug-out log with sides built up of planks.

Late in November, with most of the crew working and exploring on shore, a storm wrecked the

San Agustin. A priest and several crewmen lost their lives. All they had was the launch on the beach, their arms, and the clothes they wore.

A foraging party collected acorns, small fruit, and seeds from the Indians. Their shipmates had a fight with the natives when they found them taking planks from the wreck. Apparently the Spaniards had convinced the Indians they were neither gods nor the returned dead, and the savages were already trying to get the planks whose iron spikes would be found 345 years later.

Seventy men and a dog crowded into the small launch, the *San Buenaventura*, as it embarked for Mexico. It was a long voyage home. In their desperate hunger they ate the dog. At an island on their course they subsisted for a week on the carcass of a large tuna or shark they found washed ashore. It was a sorry end to a voyage begun so bravely. Cermeño lost his ship, his cargo, and many of his men, though he lived to tell about it.

It may have been after the surprising fight with the visitors that a Coast Miwok brave, disillusioned, went to the brass plate on the firm post and struck it with his war club and threw it away.

Others of the tribe, when the Spaniards had left, wrenched planks from the wreck to roof their houses. They opened the boxes and bales they found in the ship. It is probable that, for a time, they used silk for sleeping mats and nets and capes at a time when only royalty could afford silk in Europe. They used late Ming porcelain to hold water and their *tcipa*, acorn bread, when that ware was worth more than gold in Europe.

Dr. Heizer will show you one triangular fragment of porcelain. Chips along the edge show how some Indian tried to fashion it into an arrowhead. But the porcelain wouldn't chip like flint or obsidian, so it was given up as a bad job. Broken dishes were fit only for the shell mound — fortunately for archeologists.

In 1588, when Drake defeated the Invincible Armada, some of the sailors who were with him remembered some Coast Miwok words. When Captain John Smith sailed from England to found the first English settlement in America, there may have been an old salt on shore who told cronies about the "calphurnia" Indians.

We don't know if the Indians long remembered any European words, but it is interesting to speculate. We do know that they had the brass plate, and porcelain dishes.

END

CALIFORNIA'S FIRST Fossil Bird

LOYE MILLER

TO SOME it may seem a far cry from bird study to fossil digging — from the study of live, colorful, singing incarnations of energy to the colder interest in unbelievably ancient remains taken in fragmentary condition from the rocks. But the study of fossil birds in California has today become a really live and fascinating science. It was a small beginning and seemingly of little significance in the late 1890's when that fragment of bird bone, taken from the Third Street tunnel in Los Angeles, was sent to Dr. F. A. Lucas of the U. S. National Museum and christened by him as *Mancalla californiensis*, a flightless form of auk.

But, how short is the distance we can see into the future — even shorter it is into the opaque, material surface of a bed of fossil-bearing sandstone!

The Third Street tunnel was driven through a range of hills that limited the growth of tiny Los Angeles to the westward from Broadway. Now some half-century later the insatiable young city has reached the sea fifteen miles farther west and has enwrapped several small communities by its amoeboid creeping. Alas and alack! But we must have progress.

There is, however, no regretful shake of the head to deprecate our expanding concept and our insatiable thirst for knowledge of the birds — past or present. That's why "Fossil Birds" becomes a phase of the science, ornithology. There was only one fragment of one bone taken from that Third Street bore fifty years ago. Nowadays the city engineers are throwing the whole range of hills around in their restless squirming, but still they have found no more bird bones to cheer the fossil hunter. Nevertheless, we students of *Mancalla californiensis* have reached the sea fifty miles away at Corona del Mar and more than one hundred miles to the southeast at San Diego.

The Lucas auk has thrust back his restraining barriers even more effectively than has the "Puebla de Nuestra Señora" that spawned him. He was christened by Dr. Lucas in 1901 and he was nearly nine years old before another fossil bird was born into the household of the state whose name he bears. I wish the good Dr. Lucas could drop in from his field-camp somewhere along the Milky Way — that pathway of the Gods toward Mt. Olympus — and see how his god-child has grown.

Not until after the close of Lucas' distinguished career was a second and even tinier fragment of the bird recovered from a new field at San Diego. This was followed by other and better specimens in more rapid succession — recovered from road cuts by the way — until now we have come to expect *Mancalla* to step out of its sleeping quarters in the three million-year-old sandstones at fairly frequent intervals. The San Diego deposits seem to be unusually rich in bones of this interesting species so we have come to know the bird from "tip to toe," so to speak. The beds at Corona del Mar, uncovered by Dr. Hildegard Howard, have yielded few remains, but her energetic work has helped round out and interpret the total collection until they number over two hundred bones — which constitutes almost a plethora for any fossil bird form. Too often we have to be content with a bone or two or, worse still, fragments thereof.

But what have we learned from this abundant material? Is *Mancalla* just another name to add to the catalog of California's fossil birds so that we may boast of the great length of that list — now containing more than two hundred species?

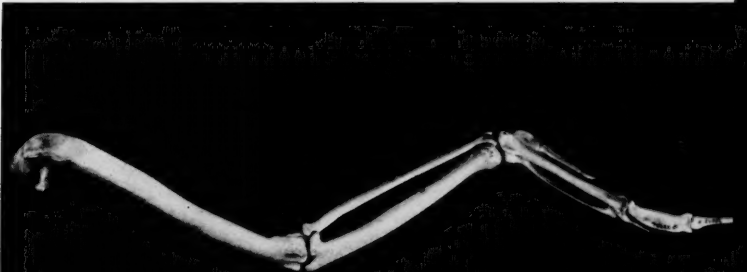
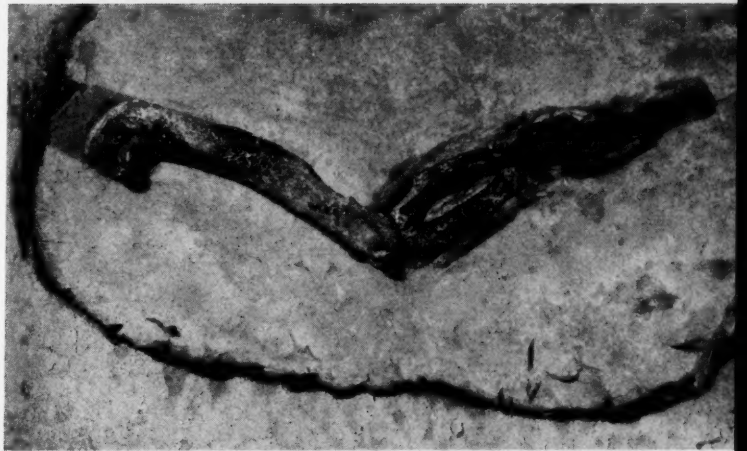
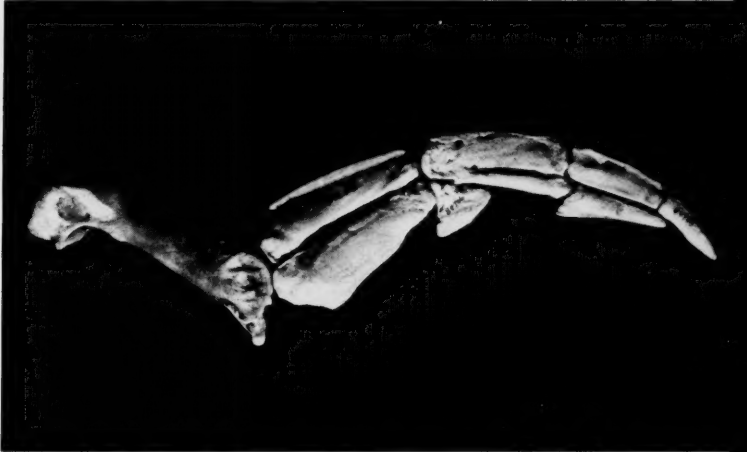
What do we learn about ornithology as a whole or of the conditions that prevailed three million years ago? What changes have taken place? What inexorable laws of nature have operated to bring about the present-day picture?

Mancalla carries a complex interest for us—geologic, anatomical, and historical. Dr. Lucas' astute mind deduced from the single bone fragment in his hands that the bird was a species of auk somewhat like our California murre but one that had lost the power of flight. Our subsequent studies dealing with complete specimens of all the limb bones have proven him right even beyond the degree that he had visualized. Loss of the power of flight suggests to the mind, at first flash, a degeneracy of the wing. If a bird once flew and now is flightless, his wings must have become too weak



Above: Humboldt penguin in Bronx Park. (Courtesy of Dr. William Beebe, New York Zoological Society)
Right (top to bottom): Humboldt penguin flipper (photo by Toshio Asaeda); flipper or wing bones of the Humboldt penguin (Bowman photo); assembled wing bones of *Mancalla diegensis* (L. Miller) from the San Diego Pliocene (UCLA and Los Angeles Museum photo); and wing bones of the California murre (Bowman).
Below: Galápagos cormorants on their nest, Tagus Cove. (Courtesy of Dr. William Beebe)

Wing bones of penguin and *Mancalla* show marked similarity because of modification for a similar purpose that has taken place in two quite different orders of birds — a good illustration of “convergent evolution.” Wing bones of the California murre show far less specialization. The murre retains the power of flight though it does use its wings also in swimming under water. The Galápagos cormorant is a species that has become flightless through degeneracy of the wing, depending mainly on its feet for underwater swimming. Wings are not needed as protection from predators on those remote islands.



to support him. But was it really a case of degeneracy or was it rather a change in function?

Flightless birds have appeared at various times and places. Especially has the phenomenon occurred among island species, from the celebrated dodo to the less widely known Laysan rail and Galápagos cormorant. These birds had unquestionably sprung from ancestors that could fly, but insular protection had permitted degeneracy of the wing without lethal effect. Whether the Cretaceous *Hesperornis* had aviator's blood in his veins, we do not know, and the history of the ostriches is still a matter of debate. In all of them, however, the original function of the forelimb seems to have been lost but not replaced. In all of them, too, there had been a strengthening of the hind limb as a sort of compensation in locomotion on dry land or in and under water.

The dodo and the Laysan rail were land birds dwelling on islands that were free of cats, foxes, and weasels so they survived until upstart man brushed them aside with child-like ruthlessness. The cormorants swim and dive with their feet and not their wings, hence a flightless form could develop in the fox-free islands of the Galápagos group.

The auks, murres, and puffins, on the other hand, are birds that fly under as well as over water. They have relatively weak hind limbs and our records indicate that they have been so fashioned ever since Miocene time, five or six million years ago. Their flight in air is a bit labored and their swimming on the surface is not vigorous or extended, but their subsurface "flight" is rapid and efficient.

Penguins of the Southern Hemisphere are also completely flightless birds. Their wings have been modified into powerful seal-like flippers which give them an almost incredible speed under water. The legs, however, have been retained as sturdy walking or even hopping organs which serve them well on their antarctic ice flows or their island homes, even permitting them to invade certain mainland areas prior to the incursion of cats and foxes from the north in late geologic time. These remarkable birds constitute a distinct and highly specialized order that seemingly have reached the climax of development for underwater flight.

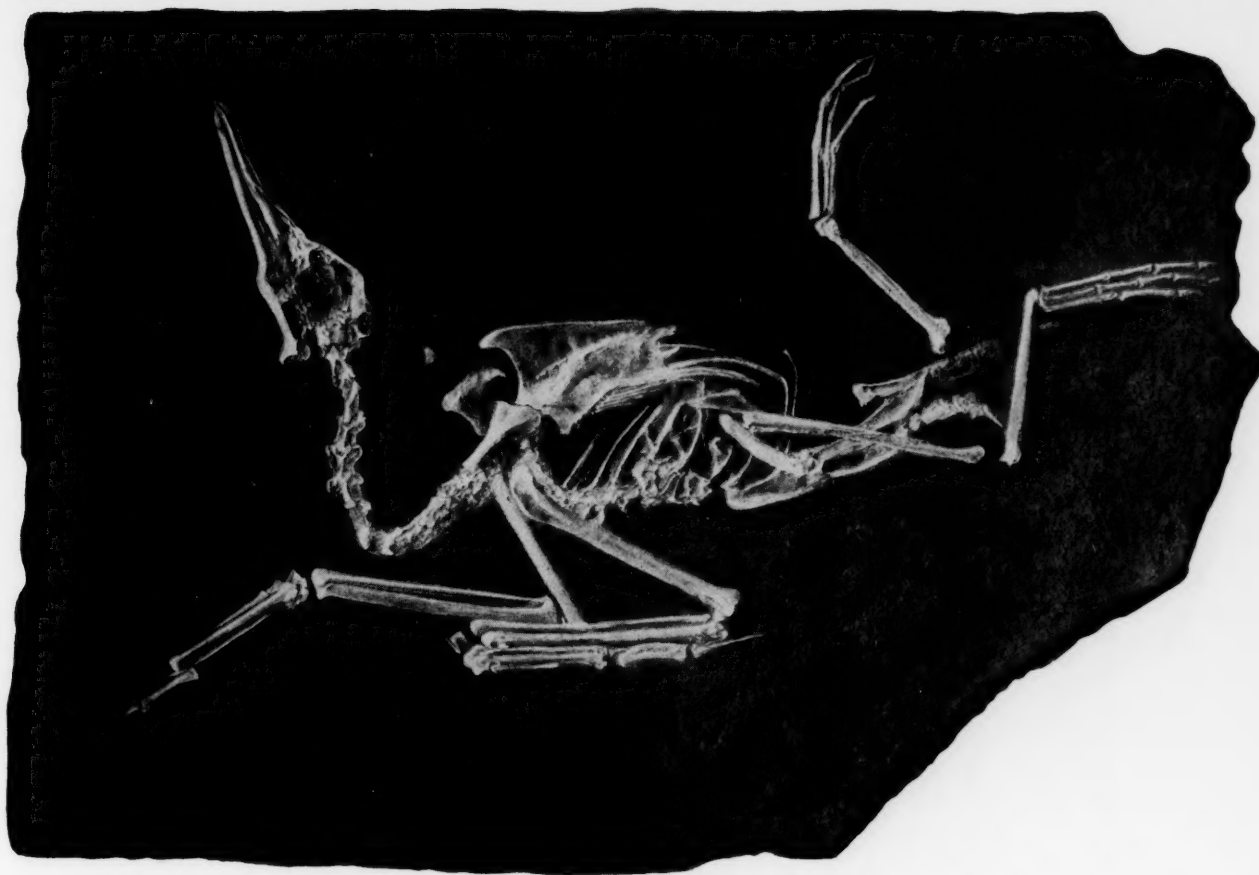
The wing bones are so closely knit together that the wing can no longer be folded. The wing feathers have become so short and stiff as to appear almost like reptilian scales instead of those beautiful, complex, and highly efficient structures that we see in the actively flying birds.

The geologic history of the penguins is a long one and is not yet completely known but the general opinion among students of the subject is that the albatrosses and petrels are their nearest of kin and that their specialization occurred near the earliest of Tertiary time when mammals were just beginning to show promise of their great future. Albatrosses and petrels include some of the most masterful aviators that Nature has evolved. Penguins represent the climax of underwater fliers. One took the high road while the other took the low road, we might say.

Auks, on the other hand, are related to those other wonderful aviators the terns, one of whose number, the arctic tern, holds the avian record for long distance migration. From such a family tree, our extinct Lucas auk branched off and strove to emulate the penguins, changed his wings into flippers and became a submariner. He seems not to have been too great a success, however, for we find his record a short one, restricted so far as we have yet learned to Mid-Pliocene time. The auks seem, however, to carry somewhere in their hereditary complex a tendency toward such extreme digression. The great auk or garefowl of Atlantic waters had not gone so far astray as our Lucas auk in modification of the wing bones but he had lost the power of flight and he "paid with his life" as the dodo did when ruthless seamen rowed their whale boats to the shore of his Funk Island home. They laid planks from ship to shore and herded the helpless creatures aboard in droves to leaven their sailor's fare of fish and salt pork. The species could not survive such pressure and the great auk was lost to our bird fauna less than a century ago.

But our fossil submarine holds for us an interest that extends beyond the story of nature's biologic experimentation. Experience has brought about in our minds an association of many species of living birds with certain types of surrounding terrain. Sandpipers like shallow waters to paddle in. Loons must have their deeper waters to dive in — and





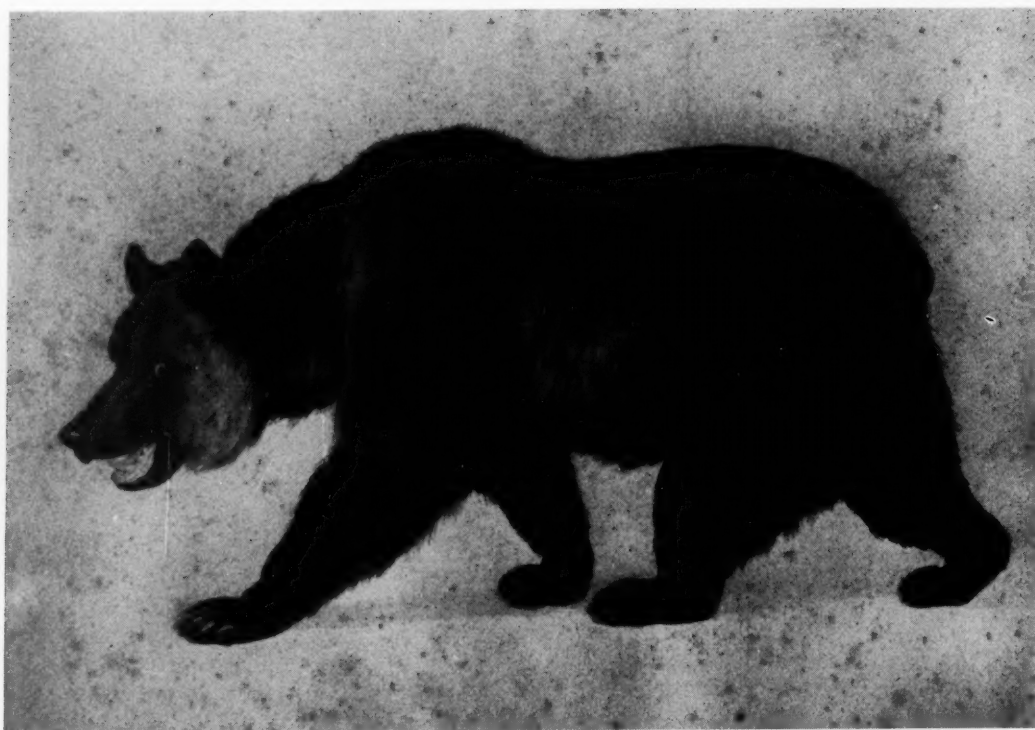
Puffinus diatomicus Miller, a Miocene shearwater from the Lompoc diatomaceous shales. The penguins are considered to have sprung from the same flying birds as the shearwaters and albatrosses. The great blocks of snowy diatomite in the commercial quarries at Lompoc split into thin layers, sometimes revealing the remains of fishes, mammals, and various birds. The bird bone, above, has entirely broken down, leaving a concave imprint darkly stained. Reversing the values to white against dark makes a photograph easier to compare with modern specimens. A whole skeleton of *Mancalla* is now being prepared.

flightless birds need those foxless islands we were talking about — places where they can breed in safety. Did we have such for *Mancalla californiensis*? We think we had. For some years, in my own thinking and speaking, the general area of Metropolitan Los Angeles has been designated a “Pliocene archipelago” — a great shallow island-studded bay extending inland almost to the limits of Pasadena. *Mancalla* found it suited to his needs.

The San Diego area seems to have had a similar history. Soledad Hill and probably Point Loma and other spots stood above the waters of a Pliocene bay beneath whose shallows there accumulated sediments that later were uplifted and crumpled into the sandstones of the Mission Hills

district. These sandstones, sectioned by city road cuts, have yielded teeth of Pliocene sharks and rays, shells of bay water molluscs, bones of sea lions, and more than two hundred specimens of the Lucas auk. Here he must have lived in comparative peace, free at all seasons from winter ice flows that bridged the Funk Island home of his less specialized cousin, the great auk — free, too, from the poultry-hungry sailor men who herded those helpless creatures across the gangplank to their boat deck. Yet *Mancalla* “walked the plank” into oblivion just as certainly as did the great auk three million years later. Why? That’s another of those fascinating questions that still confront the fossil digger. But isn’t it fun!

END



Charles Nahl's contemporary painting of a California grizzly.

TRACY I. STORER & LLOYD P. TEVIS, JR.

THE CALIFORNIA GRIZZLY

SINCE ANCIENT TIMES, mankind, as organized in groups for a variety of purposes, has usually sought some marker, symbol, or emblem to portray and envisage the purpose and ideal of each such group. Armies have their flags and their insignia, knights bore their coats of arms, nations and states hold aloft their shields and banners. Each crusade, medieval or modern, seeks to typify its purpose with a visual symbol.

In the beginnings of California — that became a full-fledged American state at once — there was a natural emblem conveniently at hand, both literally and figuratively in the grizzly bear. For the "rebellion" of American settlers at Sonoma in 1846, the quickly and crudely-designed standard bore a hint of American allegiance in the single

star and one broad stripe of red, borrowed from the national banner; and to this was added a figure of the most outstanding and powerful member of the native fauna. The choice of emblem proved more fortunate and more lasting than the cause for which the flag was first raised. Three years later the seal adopted by the Constitutional Convention of 1849 had a grizzly beside Minerva in a scene of ships and miners and rolling hillsides.

Since that time, in the century that has seen the state's original human population multiplied many times, the grizzly has continued to be the symbol of California, widely used in both public and private affairs. The grizzly itself, unfortunately, proved too formidable a neighbor to be tolerated and in consequence, it was quickly reduced in

numbers. Then a slow but effective attrition resulted in its extermination soon after California celebrated its golden jubilee.

Following its service to the Flag and Seal, the grizzly's name was used often as California was explored in detail and settled. It marks nearly two hundred place names designating topographic features, waters, and settlements. In 1952, there was a Grizzly Bear House on the road to Nevada City, and at Grizzly Springs in Lake County mineral water still is bottled under that name. There is a settlement named Grizzly in Plumas County near Beckwith, a Grizzly Bluff in Humboldt County, and a Grizzly Flats in Eldorado County. Trinity County has its Grizzly Mountain, Alameda County its Grizzly Peak back of Berkeley, and both Bear Valley in the San Bernardino Mountains and Cañada de los Osos in San Luis Obispo County attest the former abundance of the big bears in those places. There are no fewer than 22 Grizzly creeks within the state.

The bear of California has lent its name to various business houses and commercial products. In 1907, a Los Angeles tea and coffee dealer offered a "Grizzly Bear Brand." The current telephone directories of San Francisco and Oakland include among others a "bear" grill, photo service, lum-

union will consist upon the admission of California.

The foreground figure represents the Goddess Minerva having sprung full grown from the brain of Jupiter. She is introduced as a type of the political birth of the State of California without having gone through the probation of a Territory. At her feet crouches a grisley bear feeding upon clusters from a grapevine emblematic of the peculiar characteristics of the country. A miner is engaged with a rocker and bowl at his side, illustrating the golden wealth of the Sacramento upon whose waters are seen shipping typical of commercial greatness and the snow-clad peaks of the Sierra Nevada make up the background while above is the Greek motto "Eureka" (I have found it) applying either to the principle involved in the admission of the State or the success of the miner at work.

This description, written three days before the design was presented, is still in use save for some changes in punctuation, spelling, and in replacement of "crouches" by "stands." Lyon evidently



(Courtesy California Department of State)

— EMBLEM OF THE GOLDEN STATE

ber company, and collection bureau — the latter possibly feared to use the more vigorous appellation of "grizzly."

Some of the more significant and conspicuous uses of the grizzly and bear motifs are worthy of detailed description.

The Great Seal

In California, proposals for a seal were made to the Constitutional Convention of 1849. Of several designs submitted, that drawn by Major R. S. Garnett, U. S. Army, and offered by Caleb Lyon, was adopted on September 29, 1849. The description of the design was entered in the journal and reads:

Around the bevel of the ring are represented thirty-one stars, being the number of states of which the

used "crouches" to indicate position of the grizzly rather than posture, for, as one authority pointed out, "naturalists seem unable to determine the posture of a crouching bear especially when eating."

Not all of the delegates to the convention of 1849 were in favor of having a grizzly on the State Seal. O. M. Wozencraft, who had been the first

to propose the adoption of a Seal, wanted to strike out the bear and miner and replace them with bags of gold and bales of merchandise. General Vallejo, perhaps still smarting from his experiences during the Bear Flag Rebellion, did not approve of an unrestrained bear. He argued that if the bear were to be kept on the Seal, it should be represented as secured firmly by a lasso in the hands of a Spanish-Californian vaquero. Among those who wished to keep the bear untrammelled was Major Jacob R. Snyder, a participant in the Bear Flag Rebellion. When the matter came to a vote, the grizzly won by 21 to 16. To this day he stands unrestrained by the side of Minerva, and with subsequent minor changes in the design of the Seal he has moved into an even more prominent position than was allowed him by the convention of 1849.

The Great Seal, after being adopted by the convention, was engraved and first used on December 5, 1849, by the Governor — and shortly by the Secretary of State who is still its official custodian. It is a mark of authority and might be assumed to be of permanent pattern, yet such is not the case. No less than four major designs were used from the time of its original adoption in 1849 until standardized in 1937.

The original design shows the bear with lowered head turned slightly to the left munching on a cluster of grapes. The margin of the Seal cuts off the lower half of his front legs and most of his hind ones. In the second version, which appeared in 1883, the bear has turned his head somewhat to the right to give a better view of his profile. In the 1891 or third version, having forgotten the instructions that he should be "feeding upon clusters from a grapevine," the bear has stopped eating to raise his head. Apparently, something in the distance attracted his attention, for he has moved forward, and most of his feet are visible. This third version of the Seal became the basis for the official design adopted by legislative action in 1937.

Besides these four patterns of the official seal used by the Secretary of State, many purported replicas but actual variants have been employed by the state printer. This diversity came to attention in 1936 when the State Employees' Association, wishing to have blotters printed with a replica of the seal, found that practically every de-

partment had a version differing from that in the office of the Secretary of State. Indeed, as early as 1855, the commission of a captain in the National Guard bore two seals, one printed at the top with the bear sleeping soundly and that beside the Governor's signature with the bear standing!

The *Recorder* of February 4, 1937, says:

What is the bear doing? Well that depends on the version of the Seal that you happen to study. In some versions the rascal is lying down, apparently sound asleep — hibernating *al fresco*, so to speak — in others he is standing up. In some he appears to be smiling, in others growling. And in all versions he looks something like a cross between a wolf and a boar, though he is probably a grizzly.

We have consulted the California Blue Books of various years, and find a delightful impartiality in the matter of this bear on the Seal. The preference seems to incline toward drawing the dear old beast "couchant," as the pundits of heraldry would put it, but in a great many examples we have found him "statant," that is to say, standing at gaze, though what he is gazing at remains a mystery. . . .

Bear flag

On June 14, 1846, a group of American settlers revolted against Mexican authority in California. Having taken Sonoma, then a military post of the Mexican government, the insurgents needed a banner. They believed that they did not have the right to use the flag of the United States but evidently felt the need of at least a star and a stripe. Someone proposed the grizzly as a motif, an animal then common locally whose reputation for strength and unyielding resistance could be attested by all the participants. The banner was identified with their cause by being marked "California Republic." These, then, were the elements used to make up the standard for the so-called "Bear Flag Rebellion."

A considerable number of persons were involved in the incident. It might be expected that their recollections and whatever they individually wrote then or later would yield accounts of the affair and of the making of the flag that would be in substantial agreement. Unfortunately, the case is quite the reverse. Starting soon after the revolt and continuing down through the years there has been great difference in the reports as to who made the flag, the materials and colorings used, and the actual design. It is not our purpose here to enter this controversy. All we know definitely



The "Original" Bear Flag.



Another "Original" Bear Flag.



Bear Girdon.



is that a banner including a star, a stripe, a bear, and a name was prepared. Part of the controversy rages over the pose of the bear: whether on all fours or standing more or less upright. Two flags, depicting these respective poses and each supported by various claims as to authenticity in being *the* original, were long in the possession of the Society of California Pioneers in San Francisco but were lost in the fire of April 18, 1906. Crude drawings of these two and of an early military guidon are reproduced here from *The San Francisco Call* of September 7, 1890.

In 1911, the State Legislature (statutes, 1911, Chap. 9, p. 6) formally adopted the Bear Flag as the state's emblem, using the following words now in the Government Code:

420. The Bear Flag is the State Flag of California. Its length is one and one-half times its width; the upper five-sixths of the width thereof is a white field and the lower sixth a red stripe; there appears in the white field in the upper left corner a single red star, and at the bottom of the white field the words "California Republic," and in the center of the white field a California Grizzly Bear upon a grass plat, in the position of walking towards the left of the white field. The bear is dark brown in color and its length one-third of the length of the flag.

Then in 1943, display of the Bear Flag beside or

below the flag of the United States was prescribed by law for state buildings and institutions.

The Act of 1911 chose the statant bear, on all fours, but did not specify an actual design for the animal. In consequence, there has been some variation in his appearance on the "State Flag" as produced by different manufacturers. (The crude portrayal of the bear on the flag of 1846 has often been considered more porcine or lupine than ursine in conformation.)

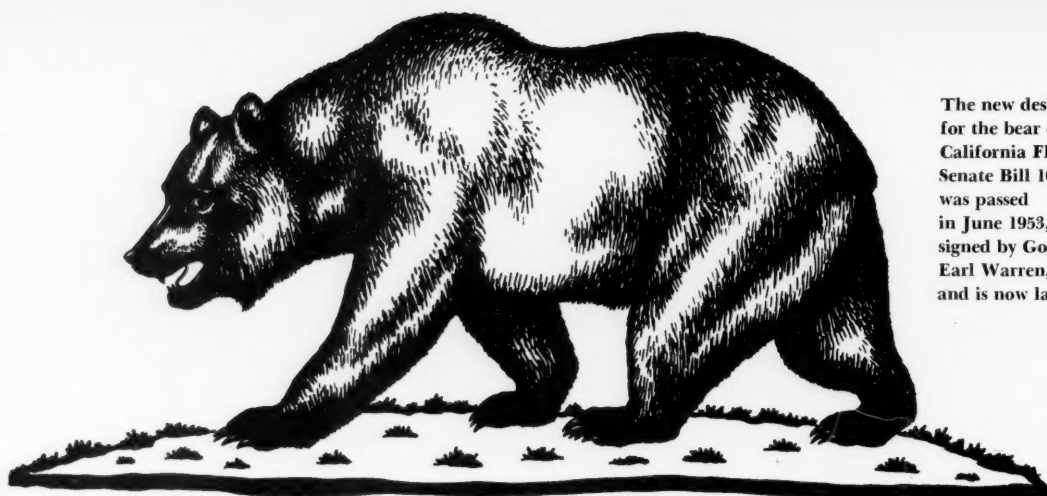
About 25 years ago, a flag manufacturer in San Francisco obtained from the State Library a photostat of a grizzly illustration that has subsequently been used for the bear on many commercially produced flags.

The original of this photostat is one of three manifestations known to us of an early illustration by Charles Nahl of a California grizzly: (1) a colored painting now in Colton Hall at Monterey; (2) a woodcut executed by Van Vleck and inscribed "C. Nahl" that appeared in *Hutchings Illustrated California Magazine* for September 1856 (1:106-108); and (3) the original mentioned above. Only the second is dated.

In an effort to fix officially on one design for the flag bear, Mr. Fred W. Links, Assistant Director of Finance, in 1952 requested aid of the present authors in obtaining a satisfactory portrayal of a

† A Bear Flag in current use, made according to the Act of 1911.

◀ Early Bear Flags as depicted in *The San Francisco Call* of September 7, 1890. (Courtesy Jack S. McDowell, City Editor, *San Francisco Call-Bulletin*)



The new design for the bear on the California Flag. Senate Bill 1014 was passed in June 1953, signed by Governor Earl Warren, and is now law.

California grizzly. In turn, Don Greame Kelley, editor of *Pacific Discovery*, was commissioned to draw such a "portrait." It was felt that the general pose of the bear should follow that of the Nahl representation, since the latter has been on the flag for a number of years. The new drawing makes the figure more in accord with what has been learned of the conformation of the California grizzly. Senate Bill 1014 of the 1953 Legislature is intended to amend Section 420 of the Government Code by adding to the last sentence the words: "... and shall be designed on the flag to correspond substantially with the following representation thereof: [here the new illustration is shown]."



Bear replicas

Far antedating official use of the grizzly as a state symbol was its appearance on a fountain at the Santa Barbara Mission. In 1808, the mission fathers had constructed a fountain in Moorish design that was fed by water brought by a trench from the neighboring canyon. The playing water fell into a large octagonal bowl, then was conveyed in a pipe that supplied a huge trough where

Indian girls were employed in communal clothes washing — the first California laundromat. The input of water to the trough was through the mouth of a stone bear carved on the head of the basin and the overflow spout at the far end had similarly a bear, of which there now remains only the front paws, with distinctive long grizzly-like claws.

Among decorative insignia using the California grizzly we have learned of several metal plaques. One, of bronze about 10½ inches long and delicately sculptured, was purchased at a second-hand store on McAllister Street in San Francisco some years ago by Mr. Francis P. Farquhar. The second, of iron, of the same size but cruder in detail, is in the State Historical Museum at the town of Shasta. The two plaques show some resemblance in posture to the Nahl illustrations. Other such plaques are reported to be in existence. No information has come to us as to their origin, manufacture, or date.

Two other uses of the bear in decorative insignia are seen in the badge of the Society of California Pioneers and in the California souvenir used at the World Columbian Exposition at Chicago in 1893.



Overland Monthly

In 1868, there was started in San Francisco "The Overland Monthly devoted to the development of the country" — particularly in literary matters. The journal was printed by A. Roman & Company and the first editor was Bret Harte. The cover and title page, throughout the life of the "Monthly," carried a small figure of a bear crossing a railroad track. Of this the editor wrote in the first issue:



The bear who adorns the cover may be "an ill-favored" beast whom "women cannot abide," but he is honest withal. Take him if you please as a symbol of local primitive barbarism. He is crossing the track of the Pacific Railroad, and has paused a moment to look at the coming engine of civilization and progress . . . and apparently recognizes his rival and his doom. . . . As a cub he is playful and boisterous, and I have often thought was not a bad symbol of our San Francisco climate. Look at him well, for he is passing away. Fifty years and he will be as extinct as the dodo or dinornis.

Harte was indeed a prophet; the last certain native grizzly of record in California was killed in 1908! (The 1916 "record" was of an escape from a zoo and the authenticity of the 1922 case is in doubt.)

Native Sons of the Golden West

A patriotic impulse among persons born in California led in 1875 to organization of the Native Sons of the Golden West (with the later collateral Native Daughters). In the first parade, held that year on July fourth, they carried a stuffed bear. In 1907, there began the publication of the "Grizzly Bear," official organ of the Native Sons. The title on the cover was decorated with the head of a grizzly and for a number of issues the journal

cover was decorated with a grizzly in various poses, fishing, sailing, and even bearing a platter with a Thanksgiving turkey. The pin of the order carries the bear motif.

Other celebrations of the NSGW soon switched to Admission Day (September 9th); and used the grizzly further as a symbol. A decorative arch erected in San Francisco at Market and Stockton streets for celebration of "the glorious 9th" in 1890 had, above portraits of Sutter and Frémont and a scene of overland travel, a huge replica of a grizzly, flanked by an Indian and a miner.

University students

Finally, the grizzly, quite naturally, has become the emblem for student activities at the University of California. Although never precisely stated, the grizzly rather than the black bear is obviously the motif, particularly as the principal opponent of "Cal" is Stanford, whose emblem is the red Indian. Before there was a Golden State, the native Indians saw no particular hazard in the black bear, but the case was otherwise with the grizzly.

Athletic teams of the Berkeley Campus are "The Bears." When the University expanded to include a Los Angeles Campus, the southern student representatives became "The Bruins." (A shortage of bear terminology precludes extending the idea to the other six campuses.) The sons and daughters of California on both major campuses have a variety of stickers and labels for their books and automobiles on which the bear is the decorative symbol.

Wherever adherents of the University gather, in a campus rally, at a Big Game, or as nostalgic alumni gathering in a distant land, the bear is always in evidence as in the "Big C" song and accompanying yell — well known both to California and Stanford rooters.

END

The Golden Bear of California has acquired academic standing.



THE MILKY WAY

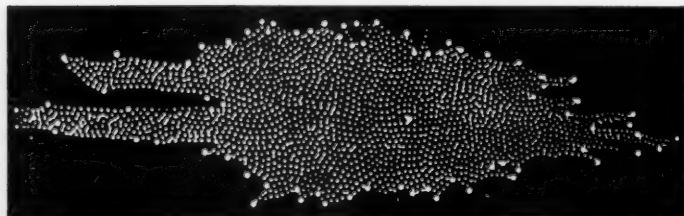


WHEN we look at the stars on a clear dark evening of early summer, we see an irregular band of light curving across the sky like a broad arch above the eastern horizon. The patchiness of the light arises from the alternation of dark sky-lanes with comparatively bright areas. In general, the band of light lies along a great circle that divides the sky into hemispheres. (See first photo.)

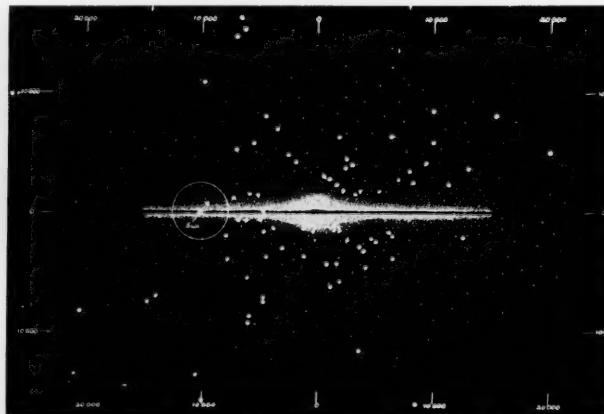
The Milky Way has had its share of legends in ancient times. According to a Greek version, it was spilled across the heavens by Hera (Juno of the Romans) as she suckled the infant Herakles (Hercules). A more ancient account made it the junction of the halves of the sky put together at the Creation. To look upon

the light as a river in the sky was quite common, but perhaps the most poetic version was that of the Algonquin Indians. For them the Milky Way marked the trail departed warriors followed on their way to the last hunting grounds, and the bright stars were as many campfires burning along the way.

Beginnings of scientific explanation of the phenomenon date from Galileo's discovery, in 1610, that the diffuse glow is really the sum total of light from millions of distant stars too faint to be seen individually unless with a telescope. By the beginning of the 19th century — after Herschel had completed his sample count of faint stars in all parts of the sky — it was generally agreed that stars do not extend indefinitely in



▲ **Diagram A.** Cross-section view of the Galaxy according to Sir William Herschel. This was the first comprehensive view of a stellar system which showed our sun as one of millions of similar stars.



◀ **D**
To t
our s
have
The l

ASTRONOMY

Conducted by
George W. Bunton
& Leon E. Salanave

← The Milky Way, from the star clouds in the Scorpio-Sagittarius region (left) to the bright star Altair in Aquila (upper right). The center of the Galaxy lies in the direction of the star clouds.
(First photo—composite from negatives obtained with the 5-inch Ross lens, Yerkes observatory)

→ Messier 31, the great spiral galaxy in Andromeda, from a negative obtained with the 48-inch Schmidt telescope, Mt. Wilson — Palomar Observatories. This great stellar system is similar to our own Galaxy; recent revision of distance determination places it one and a half million light years away.
(Second photo)



space about the sun, but are distributed in a great flattened swarm. Herschel devised the famous "grind-wheel" analogy to explain his view of the stellar system he discovered, now called the Galaxy. Modern studies of the distribution of stars in space have modified the details of the pattern and added to its grandeur, but Herschel, a century and a half ago, was remarkably close to the truth. (See diagrams A and B.)

These are some of the important conclusions of modern astronomical research on the Milky Way:

1. The faint stars that make up the Milky Way are part of a vast spiral structure of 100 billion stars, or more. The nucleus of the Galaxy is about 30,000 light years from the sun, beyond the group of stars associated with the constellation Sagittarius. Thus we find our solar system is far from the center of the swarm of stars to which the sun belongs.

2. The spiral structure of our Galaxy resembles that of some of the "nebulae" photographed by the big reflecting telescopes (see second photo). Recent studies of the distribution of stars, gaseous nebulae, and radio-emitting regions have clearly traced out for the first time the suspected spiral character of our own Galaxy. Also, the kinds of stars found in the spiral arms and

in the nucleus of a galaxy seem to have definite family traits. For instance, extremely luminous hot stars such as Rigel (in Orion) are found in the spiral arms, along with clouds of dust and gas; such associations are never found in the central regions of a galaxy.

3. The breadth of our Galaxy is 100,000 light years, its thickness about 10,000. But other galaxies have appeared to be uniformly smaller; even the Great Spiral Nebula in Andromeda measured up to only half the size of our own Galaxy. Now, if we learn anything from the study of astronomy it is that we can never count on being a part of anything that occupies a central position or is exceptional in any way. The apparently exceptional size of our Galaxy has bothered astronomers for some time, but just last year the dilemma was solved. It seems that the methods heretofore used to estimate the distances of other galaxies have been too conservative — they are actually twice as far away as previously estimated! The calculated value of a galaxy's diameter based on its distance has therefore to be doubled, and our own Galaxy, though still a giant, no longer appears to be exceptional. Any remnants of the geocentric view have thus received the final blow; *sic transit gloria mundi!* L.E.S.

← Diagram B. Cross-section view of the Galaxy according to Oort.

To the left is shown a circle with a radius of 6,500 light years, centered at our sun. Most of the stars of the Milky Way fall within this circle; thus we have actually observed a small sample of the entire system.

The large white dots represent globular star clusters.

Where animals live

Zoogeography of the Sea. By Sven Ekman. Sidgwick & Jackson, Limited, London. (Macmillan, New York.) 1952. xiv + 417 pp., 121 figs. \$6.50.

Since the publication of the original German edition in 1935, Ekman's *Tiergeographie des Meeres* has been the standard reference on marine zoögeography, although copies have been almost unobtainable in recent years. Although substantially the same book, this English edition is actually a complete revision, written in Swedish by the author and translated directly into English. While the illustrations have been reduced from 244 to 121, most of the omissions are illustrations of animals; many of the figures are replacements, from recent literature, of older maps and diagrams. Criticisms of the earlier edition have been used by the author as inspiration for revision rather than incitements to rebuttal, and he has canvassed a remarkable amount of literature to make this synthesis. Almost any specialist may be able to point out some work in his particular field that has been missed, or to some animal whose distribution he feels deserves particular mention, but few will be unable to profit from a careful reading of this book. As a scholarly treatment of an extraordinarily vast and diverse literature, this book is a remarkable achievement, and this new edition reinforces its position as one of the standard reference works about the sea. An interested layman who picks up this book to find out something about where the animals of the sea live and of their characteristic assemblages in the various regions of the sea will be amply rewarded. If he should think the treatment too detailed, he should remember this comment (p. 100): "But still, how recent is our knowledge! When the 18-year-old Georges Cuvier travelled in 1788 to the coast of Normandy to study its fauna, it was the more than 2000-year-old writings of Aristotle which he used as his reference book."

JOEL W. HEDGPETH

*Scripps Institution of Oceanography
La Jolla, California*

Zoogeography of the Land and Inland Waters. By L. F. de Beaufort. Textbooks of Animal Biology Series. Sidgwick and Jackson, Limited, London. (Macmillan, New York.) 1951. 208 pp., 10 figs. \$5.00.

Dr. de Beaufort, the dean emeritus of European ichthyologists, brings forth his ideas on zoögeographic distribution in this small and very concise book. Although it is rather well written, it covers so much material that its usefulness will be limited to the more advanced students of animal distribution. More illustrations, especially distribution maps, would have been very helpful. A short bibliography of 132 references is presented at the end of the book.

Steinhart Aquarium

EARL S. HERALD

California Academy of Sciences

DISCOVERY IN BOOKS

Earth, eons, and evolution

Earth Song: A Prologue to History. By Charles L. Camp. University of California Press, Berkeley and Los Angeles. 1952. 127 pp., numerous drawings, charts, and diagrams. \$5.00.

Life of the Past: An Introduction to Paleontology. By George Gaylord Simpson. Yale University Press, New Haven. 1953. xii + 198 pp., drawings, diagrams. \$4.00.

The way a new world opens to one, especially in youth, may decide his entering in, or his passing by with a glance. At 17 we shared with several other boys the thrill of a fossil search below the rim of the Grand Canyon, with none other than Dr. John C. Merriam directing things. Perhaps a confusion of interests kept this particular novitiate from subsequently joining the fraternity of paleontologists; however, our interest in their science has been more than glancing. Alongside Camp and Simpson on our shelf stands *The Living Past*, bought that same summer at Grand Canyon when it first came out, and autographed by Dr. Merriam — the eminent paleontologist was then president of the Carnegie Institution. Were he not long since claimed by the living past, we are sure he would consent to our borrowing his title. His book can still be, along with those presently reviewed, an inspiring opener to the world beneath the rocks, a world not dead in the sense of final and finished — some scenes and acts have crossed the stage, but the show is continuous. If Loye Miller's short article in this issue has made you want to read on, — we hope many are thus affected, — these books are for you.

Earth Song is one of the Chronicles of California, a series launched by the University of California, under the general editorship of John W. Caughey and the late Herbert E. Bolton, "as an enduring commemoration of the state's centennial." Designer John Goetz has given Dr. Camp's book its own individual format, however, with two-column pages wider than high — this gives full sweep to William Gordon Huff's many panoramic visualizations of ancient landscapes with the animals that roamed therein (maps and text figures are drawn by Owen J. Poe). Although the excess of width over height would be awkward in a heavier book, here the designer has hit it right, achieving a working harmony between the two-ply text and the heterogeneous illustrations — no small feat!

The achievement of the author, who is professor of paleontology in the University of California, is to give a brief history of earth and its evolving life, generalized, yet at the same time telling the story of that part of earth we have in the last moment of time called California (not guilty of confined thinking, he uses the name in a regional rather than a political sense, ranging widely over the West as suits a story in which state lines are a fleeting impertinence!). Interleaved with the solid strata of Dr. Camp's account are passages — italicized prose — brightened with the fire of poetic phrasing (dryboned pedants curl and crackle on exposure). Thus the Contents reads: *Prelude*; Introduction; *Record of the Rocks*; Earth Story; *Enigma*; Rocks of Land and Sea; *Tale of the Sea Rocks*; Life in Early Seas; Life Reaches Land; *Song of Salamanders*; etc., ending with California on the Changing Earth; California's Changing Life; *Destiny*. Those passages are ornamental, perhaps, yet for giving life, action, color to the play, we find them sound stagecraft. After all, the book is not for other professors — it is for you and me, and the whole concept of it is to invite our reading.

After we have read, we may feel somewhat breathless at the span of time we have been whisked through. The

chief sense gained, however, will be one of ever-changing continuousness, as of an endless parade (to switch metaphors). We watched it pass in review until our unit came along, and now we have joined the march; looking to what follows we can see only as far as the next corner around which those coming after are hidden though we can hear the ruffle of countless feet. We have watched the earth-ball form and the crust cool and crack; the seas come and the mountains build and crumble; the sediments mass; displacement, uplift, erosion; the seas come and go. We have read the rocks and watched the parade of life: energy, protoplasm, the algae, protozoans; trilobites, lungfishes, dinosaurs, camels, ground sloths; Sandia-Folsom hunters, Basketmakers, Pueblos, Spaniards, Americans. We have seen the slow march of the eras: Pre-Cambrian, Paleozoic, Mesozoic, Cenozoic — eons of time to the in-

Earth Song,
chapter head—
Courtesy the
University of
California
Press



comprehensible extent of over three billion years. And we have found enough detail to answer the whys of such characteristic features as earthquakes, oil, the La Brea tar pits, the Sierra, the unique flora. This is a book Californians have long needed. Dr. Camp's fulfillment of the need leaves little to be desired.

Earth Song, we venture, has been and will be read by many who want to broaden their knowledge of California's pre-history, and by others merely diverted at first to an attractive book. To all of you who are impelled by the vitality of Dr. Camp's presentation to gripping the fundamentals of his science and thereby gaining the threshold of understanding evolution, we heartily recommend George Gaylord Simpson. He also is preëminent in his field — curator of fossil mammals and birds in the American Museum of Natural History and professor of vertebrate paleontology at Columbia University — and moreover, he, too, has the rare gift of imparting with utmost clarity, but without writing down, what he knows and thinks, to us who are not technically equipped. His book, *The Meaning of Evolution* (Yale, 1949) has in fact been reissued (revised and abridged) in a 35-cent Mentor edition. Of it *The New York Times* said, "This book is, without question, the best general work on the meaning of evolution to appear in our time."

"To those who follow that science, nothing is more lively than the study of the dead remains of ancient life," Dr. Simpson opens his Preface to *Life of the Past*. What he sets out, then, to prove is that the work paleontologists do

has meaning and value beyond their immediate contribution to the sum of knowledge, and that some understanding and appreciation of the science is worthwhile to all of us. Dr. Simpson is well armed for the task, not just because of the gifts previously mentioned, but even more from his own central concern with evolution; he would show us "the ways of organic change, and especially the evidence of past life on the nature of life, the reasons for its evolution, and the meaning of all this to us today."

Taking "A Walk Through Time" with Dr. Simpson, we see how the paleontologist works, how he knows "where to dig"; we are introduced to the history of the science, with both amusement and amazement at some of the untruths once seriously believed. (Some "old errors never die" — e.g., the notion "that a paleontologist can reconstruct whole skeletons from a single bone." How he *does* reconstruct them is just as fascinating.) We get a glimpse of ancient plant and animal communities, and see that life has always met the same problems in the same ways; we see how past land features can be surmised, at least in the broadest terms of continent configuration and interconnection, through evidence of animal and plant distribution in space and time. (Dr. Simpson is not, himself, a Continental Drifter — "It seems probable that all major features of animal and plant geography can and should be accounted for without assuming any great past differences in positions and relationships of the continents.")

Anyone who has progressed from mere wonder at the infinite variety of living things to curiosity about what constitutes a species in the scientific sense will find a difficult question clarified, through understanding how orderly classification is arrived at, and especially how new species are now believed to arise. The latest concepts of classification stem "from the facts, which are simple and even seem commonplace nowadays, that organisms vary and that they change in time. Subtleties become involved with realization that it is *populations* of organisms, and not individuals, that vary significantly and that evolve in the course of time. The biological and evolutionary unit [species] in nature is a group of more or less similar organisms living together and, if reproduction is sexual as it is in most organisms of all sorts, interbreeding with each other. The systematist is, or we now know that he should be, classifying populations, not specimens. A population has no 'type.' It is what it is, a group of organisms, no two quite alike, embracing certain ranges and sorts of variation, and with every variant just as much a member of the population and just as representative as any other. Designation of one individual as a 'type' and comparing others with it, each as an isolated object, simply does not make sense in view of these fundamental truths about organisms in nature." This seems to us one of the most important ideas to be gained from the book. And paleontology's signal role is that of enabling us "to see what we cannot see in living organisms: the actual changes in populations under completely natural conditions and over periods of millions of years."

An appended "Review of the Forms of Life," a brief general reading list, and a thorough index complete this eminently useful and readable book, which we commend as indispensable to a basic library of the natural sciences.

D.G.K.

The Mustangs. By J. Frank Dobie. Little, Brown & Company, Boston. 1952. xvii + 376 pp., illustrations by Charles Banks Wilson. \$6.00.

Regular Dobie readers will have already put *The Mustangs* up alongside *The Longhorns* and any they own of the dozen others by that dean of Southwest writing men. If this is your first Dobie, you will want to work backwards till you've corralled the whole string. Or if you just love horses, or the West in books of living history, you will want this chronicle of the Spanish horse in North America as it could only have been written by J. Frank Dobie — Texan, who "was beginning to learn to ride almost before I finished learning to walk," scholarly historian, and craftsman with words.

How the mustang came, out of the Barb and the Arabian, by way of Andalusia to New Spain, how he passed from conquistador to Indian to wildness on the Western ranges where he may have numbered two million at his zenith, how the mustangers brought him down to a present pitiful remnant — this is Dobie's story, racy with anecdote, racing through the centuries with the hot blood of untamed men and untamable horses ranging free over a wild land. It is a big, heartfilling story, and heartily told.

U.S. 40: Cross Section of the United States of America. By George R. Stewart. Houghton Mifflin Company, Boston. 1953. viii + 311 pp., 92 photos by the author, maps by Erwin Raisz. \$5.00.

The usual habit of "travel" books, "scenic" guides, and such, is to emphasize the spectacular, the "colorful," the "unusual." The essence of George R. Stewart's new best-selling *U.S. 40* is commonplaceness — with reference to the subject matter but emphatically not to the way it is presented. Striking a balance between pictures and text, even as *U.S. 40* strikes an average across the United States, the author of *Names on the Land*, *Fire, Storm*, and nine or ten other books, tells the story of the transcontinental highway route that is midmost, directest, most businesslike. By skilfully braiding the strands of history and physical geography with the plants, the animals, and people that live or travel along this way, George Stewart has shown that even the average of our nation is very much worth noticing, writing about, and reading about.

Perhaps one of the reasons for the great success of this book in just its first few months is the very fact of its identity with the average, the everyday of America and Americans, as opposed to the overworked superlative or extraordinary. In an opening chapter Mr. Stewart tells a good deal about his own background and history as a motorist; but granted he has probably driven more than the average in his forty years at it, getting behind the wheel with him you feel he is representative of millions of us in our love of driving for its own sake, of changing scenes, of the bigness and freedom of movement we enjoy in our land, even in the averageness of the cars he has owned. Where he excels the average of us is in his capacity to extract the meaning from what he sees, in his knowledge of the history laid open along the way as in a book, and in his particular gift for writing these things down with simplicity and humor so we may both learn and greatly enjoy. Having seen a cross section of America through George Stewart's windshield, we know better how to see through our own. The everyday is worth a closer look.

Tornadoes of the United States. By Snowden D. Flora. University of Oklahoma Press, Norman. 1953. xiv + 194 pp., 45 photos, numerous charts. \$3.50.

Anyone who had seen a locomotive picked up by the wind and set down on an adjoining track but headed in the opposite direction, might be "inclined to credit almost any" account of tornado freaks, "except, of course, such highly improbable reports as the one that an iron kettle was turned wrong side out without cracking or the one that a rooster was blown into a jug with only his head sticking out." This serious yet highly readable account of tornadoes by a leading authority — Snowden D. Flora was 32 years section director of the Weather Bureau for Kansas — is livened with anecdote, and made practical by instruction in "How to escape Death and Protect Property." The scientifically inclined will be interested in "Causes and Structures of Tornadoes," and those who followed the recent discussion in *PD* of spiraling by bats, men, and such, will be intrigued by the subhead under the above, "Much similarity to whirl in bathtub." Californians who read 1953 tornado news with a trace of smugness may be slightly jolted to learn that this state "has occasionally experienced these storms" — four in 34 years, totaling \$335,500 property loss and two deaths. Northern California smugness can be restored by the statement that all four "occurred in the southern part of the state." The book goes well armed with statistics in tabular form.

Evolution of the California Landscape. By Norman E. A. Hinds. Bulletin 158 of the Division of Mines, California Department of Natural Resources, San Francisco. 1952. 240 pp., profusely illustrated with photographs, maps, drawings, diagrams; "Geomorphic Map of California," "Shaded Relief Map of California," folded inserts in back. \$2.58.

Although bearing the publication date of December 1952, this newest in a splendid series of Californian handbooks was received just as this issue went to press, hence can not be accorded its due here. Professor Hinds of the University of California, Berkeley, is one of our foremost geomorphologists, author of a standard college textbook on the subject. But his story of the building of California's magnificent present landforms is shorn of technicality and may be recommended unhesitatingly to anyone with serious interest — it is by no means *light* reading. With this and the two Bulletins noted opposite this page (which are much more than guidebooks), California's Division of Mines under the scientific leadership of Dr. Olaf P. Jenkins has launched an interesting and informative series that all of us should be proud of, own, and use.

Birds and Mammals of the Sierra Nevada, with records from Sequoia and Kings Canyon National Parks. By Lowell Sumner and Joseph S. Dixon. University of California Press, Berkeley and Los Angeles. 1953. xvii + 484 pp., 8 full-color plates, 46 halftones, 2 maps. \$7.50. This handsome new book, while designed in part to replace Grinnell and Storer's ponderous *Animal Life in the Yosemite* (1924, reported by the Press to be out of print), is "wider in scope than any previous work" on the animal life of the Sierra Nevada, although omitting reptiles and amphibians. It is hardly a knapsack item, but if you are camped or cabined in the Sierra this summer, it will more than pay for its weight in pleasure and information. D.G.K.

GUIDES TO WESTERN RECREATION

SUMMER is the season of guidebooks, road and trail maps, and sundry treatises on a variety of pursuits considered recreational. Wherever you may go, take along a good map and the best available guide to the region. Even if you are planning only one-day excursions in your own or adjoining counties, a handbook may show you interesting things you did not know existed a few minutes away from home. Our list is obviously incomplete.

Geologic Guidebook of the San Francisco Bay Counties: *History, Landscape, Geology, Fossils, Minerals, Industry, and Routes of Travel.* Prepared under the direction of Olaf P. Jenkins. Bulletin 154 of the Division of Mines, California Department of Natural Resources, San Francisco. 1951. 392 pp., profusely illustrated, maps, charts. \$2.58.

With 28 expert authors, this fascinating volume is a goldmine of information that will enrich any excursion within the nine Bay Area counties. It cannot be described in so brief a space, but to see it is to need it!

Geologic Guidebook Along Highway 49—Sierran Gold Belt: *The Mother Lode Country* (Centennial Edition). Prepared under the direction of Olaf P. Jenkins. Bulletin 141 of the Division of Mines, California Department of Natural Resources, San Francisco. 1948. 164 pp., profusely illustrated, maps, charts. (Temporarily out of print.)

The great success of the Mother Lode guide inspired the Bay Area guide. This one also contains a good deal of California history, and should go along on any unhurried trip into the Sierran foothill region from Yuba Pass to Mariposa. A new printing will be ready soon.

Scenic Guide to California: *A Completely New Guide Covering the Entire State of California.* By Weldon F. Heald. H. C. Johnson Scenic Guides, Susanville, California. 1950. 112 pp., photos, maps. Paper, \$1.50.

Scenic Guide to Oregon. By Weldon F. Heald. H. C. Johnson Scenic Guides, Susanville, California. 1951. 100 pp., photos, maps. Paper, \$1.50.

The name of Weldon F. Heald is full assurance of the worth of these two in a series of handy reference guides covering the 11 Western states. Points of interest are described in alphabetical order: Alturas, Anza Desert State Park, Bakersfield, Big Basin Redwoods State Park, etc., to give an idea of the "superheadings" under which particular features are treated in detail (the extent of which is indicated by 700 place names in the California index). These Heald-Johnson collaborations are an excellent value.

If Yosemite National Park is your goal, there are three recent issues in the **Stanford Outdoor Books** series: **Illustrated Guide to Yosemite Valley** by Virginia and Ansel Adams, fifth ed., 1952 (128 pp., photographs and sketch maps, paper, \$1.50); and **Trail Guide to the High Sierra Camp Areas**, 1953 (48 pp., illus., maps, paper, \$1.85), and **Pocket Guide to the High Sierra Camp Areas**, 1953 (map folder with descriptive text and trail profile diagrams, \$1.00), both by Lewis W. Clark and both for Yosemite. These useful guides are published by Stanford University Press. And we note that our own printers, the Gillick Press, have another edition of Starr's **Guide to the John Muir Trail and the High Sierra Region** on the press for the Sierra Club, publishers, who hope to keep up with the year-in, year-out demand for this standard guide with its excellent, highly detailed trail map inserted in the back (xiv + 130 pp., \$2.00).

Do your recreational pursuits follow waterways? A **Sunset Sportsman's Atlas** (Lane Publishing Company, Menlo Park, California) may be your best guide. At least four of these plastic-cased, paper-bound map books are on the stands: **San Francisco Bay and Delta Area: Boating, Fishing, Hunting**, by C. E. Erickson, 1952 (32 pp., \$1.50); **Southern California Coast: Boating, Fishing, Beaches**, by C. E. Erickson, 1953 (32 pp., \$1.50); **Colorado River and Lake Mead: Boating, Fishing, Exploring**, by C. E. Erickson, 1952 (from Lake Mead to the Gulf of California, 32 pp., \$1.50 — we hope future editions will not be printed in light green ink!); and **Puget Sound and Northwest Waterways: Boating, Fishing, Hunting**, by James W. Cutter, 1953 (48 pp., \$1.75). Mr. Erickson is now afield getting data for a High Sierra atlas in the series (makes us wish we'd stayed in the map business!—Ed.).

If fishing is your summer love, the Lane Publishing Company has another useful manual for you, **How to Fish the Pacific Coast: A Manual for Salt Water Fishermen**, by Raymond Cannon, 1953 (xi + 337 pp., line cuts; limp leatherette, \$4.00). With 30 years experience behind him, the author has produced the "book Pacific Coast salt water anglers have wanted for years; it covers . . . how to find; how to catch; and how to identify positively the 207 marine game fish that range from Vancouver, B.C., to San Quintin Bay in Baja California" — so it says on the jacket. Inside, it makes us want to get started on our own 30 years experience of a noble sport. . . . And if you, too, have an 8-year-old boy ready and eager for initiation into the fraternity, and you need some help with the by-laws yourself, there is a little book called **First Fish (What You Should Know to Catch Him)**, by C. B. Colby (Coward McCann, Inc., New York, 1953, 48 pp., author's drawings on every page, \$2.00) — a really usable father-son item.

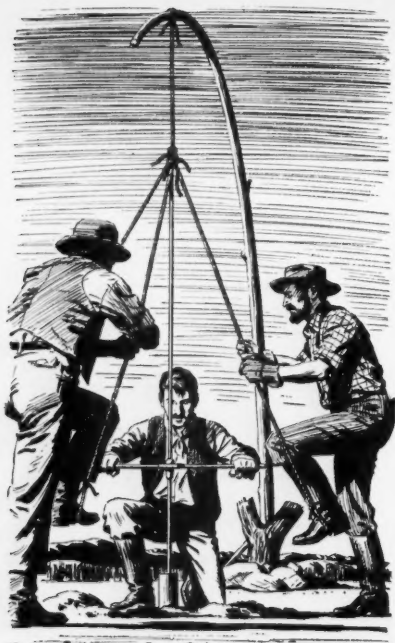
EASY CHAIR COMFORT



LONG RUGGED WEAR

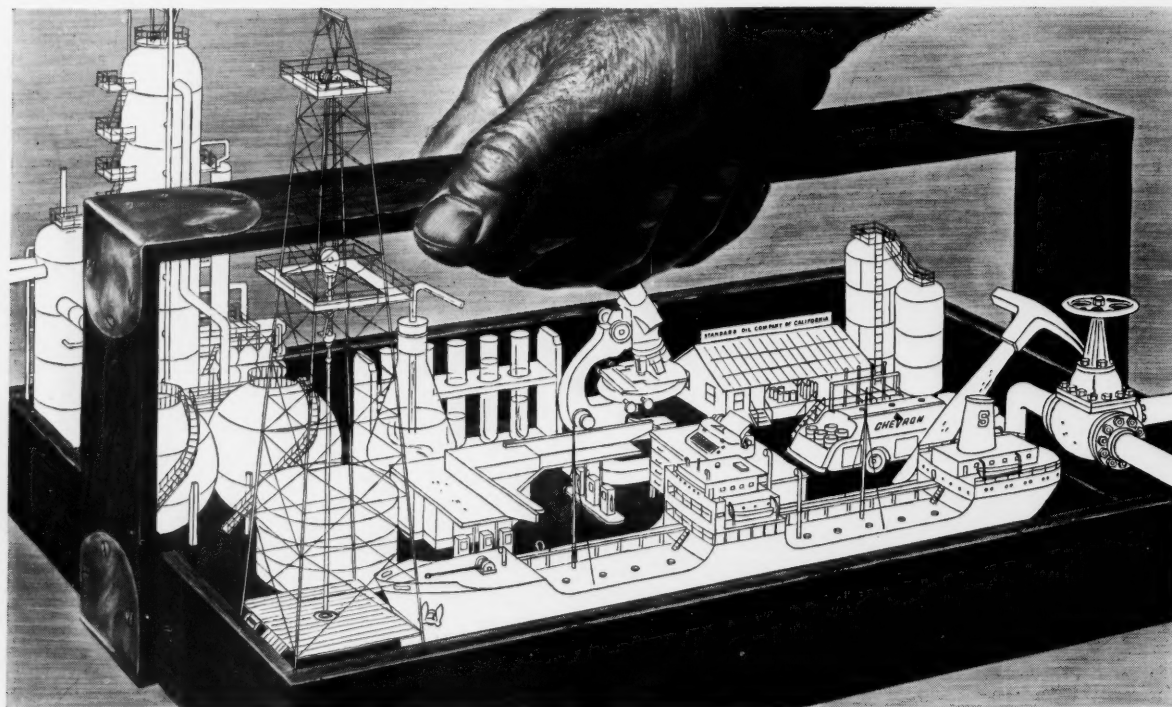


AMERICA'S FINEST OVERALL
Since 1850



How his \$51,000 tool kit works for you

Yesterday—*Manpower* and a drill rig contrived from a springy sapling, cable and drill bits sank our first wells. Since the rudimentary tools restricted their depth, they produced little oil. The "tea kettle" refineries of the day were limited, too. They utilized only a portion of the petroleum and turned out a small number of useful products.



Today—Each of our 34,750 Standard Oilers works with an average \$51,000 worth of tools. They use diesel-electric drill rigs to tap oil pools as far as three or more miles deep. With refinery units that rearrange the structure of petroleum molecules they make each drop of crude useful. Ingenious production, refining and research "tools" like these enable Standard Oilers to make more than 1100 different products from a barrel of oil . . . gasoline 50% better than it was 25 years ago, and wear-saving lubricants; ingredients for

wrinkle-resistant fabrics, low-cost plastics and work-saving detergents; sprays to increase farm crops; asphalt for roads, and many more. Standard's investment in "tools" to make oil serve you better amounts to \$1,772,000,000. That's \$51,000 worth for every Standard Oiler. With this \$51,000 tool kit he not only makes more products—he makes them better, cheaper, more easily available. Questions or comments are always welcome. Write: Standard Oil Company of California, P. O. Box 3495-A, San Francisco, California.

STANDARD OIL COMPANY OF CALIFORNIA *plans ahead to serve you better*

